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THE RHODESIA
Agricultural Journal.

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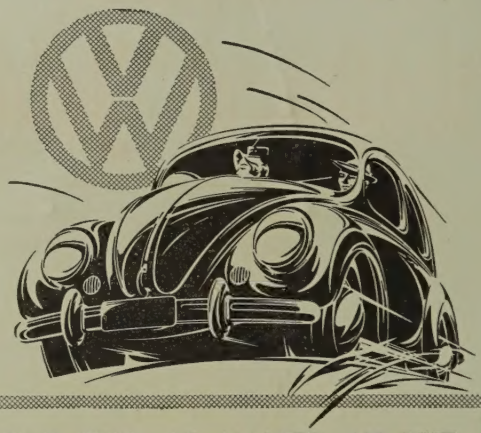

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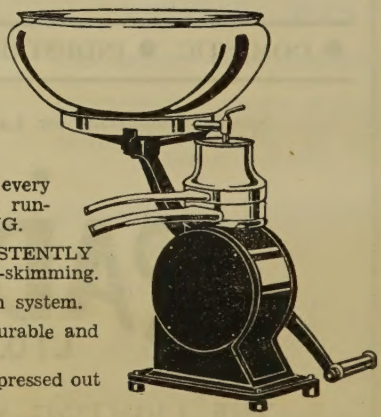

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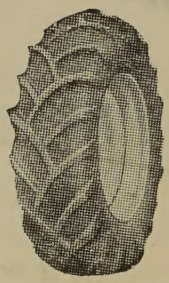

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Agricultural Journal

THE JOURNAL OF THE MINISTRY OF AGRICULTURE
Southern Rhodesia

Acting Editor : Marie H. Pardy, B.Sc.
(Assisted by the Staff of the Division of Agriculture and Lands).

Vol. XLVIII, No. 6 November-December, 1951

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Refrigerator . . .

Food goes bad because of the activity of certain micro-organisms. Under cold conditions these microbes fail to grow and the food remains fit to eat. In a domestic refrigerator a volatile liquid called a "refrigerant" is made to boil and in so doing absorbs heat from its surroundings which, of course, include the space used for storage and reduces their temperature to a point low enough to prevent food going bad. The vapour from the refrigerant loses its heat to the outside air and as it does so condenses back to a liquid ready to be boiled again. The most useful refrigerants — ammonia, methyl chloride, sulphur dioxide and carbon dioxide—are all products of the British chemical industry.

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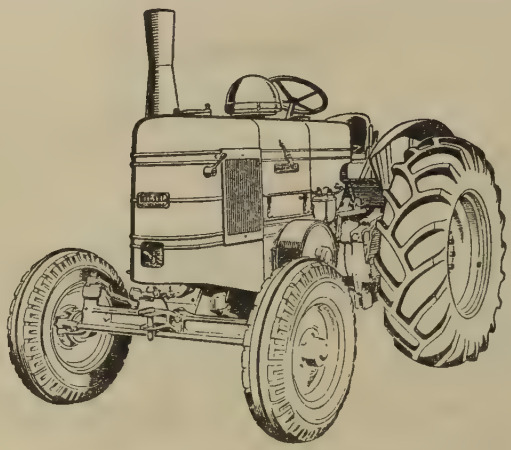

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THE RHODESIA
Agricultural Journal

Vol. XLVIII, No.6 November-December, 1951

Editorial

Notes and Comments

HORMONE WEED KILLERS.

In this issue we publish an article on Hormone Weed Killers by Dr. Altona.

Much has been done with weed killers in the Union of South Africa and at present experiments, using the Amine Salt of 2,4-D, are being carried out on maize on farms in the Mazoe Valley, Umtali, Gatooma, Nyabira, Karoi, and Fort Victoria.

Experiments with Hormone Weed Killers are also in progress at Matopos Research Station. It is hoped to publish results of these experiments at a later date.

GWEBI AGRICULTURAL COLLEGE: DIPLOMA DAY.

Wednesday, December 5, 1951, was an historic day for Gwebi Agricultural College, for it was its first Diploma Day since the College opened in February, 1950.

Nineteen students were successful in gaining their final diplomas, which were presented to them by Mrs. J. M. Caldicott, wife of the Minister of Agriculture.

There was a large gathering present who were welcomed by Dr. W. L. Fielding, Principal of the College, and Mrs. Fielding.

Mr. J. M. Caldicott, the Minister of Agriculture, in his speech said, that in future it was hoped to expand the College so that more students could be accepted. Such expansion, however, would require additional staff, buildings, etc., and would also necessitate raising the tuition fees.

Tributes were paid to the high standard of work at the College by Mr. D. C. Lilford, Chairman of the College Council, Lord Acton and Mr. N. G. Barrett, M.P.

Dr. Fielding read his report on the work of the College and complimented both the staff and students not only on their hard work in the field of study, but also on their keenness and energy in the fields of sport and recreation, as the staff and students had had to build up the latter from scratch.

To-day, among other activities, the College could boast of a Students' Council, a Sports Committee and a Recreation Committee, and already Gwebi College was becoming known in sporting circles for its cricket and rugby.

After the presentation of Diplomas, tea was served and the College was open for inspection.

The following received Diplomas:—

M. A. J. BAILEY.
J. M. BAINES.
K. N. BAGSHAW.
M. P. BARKER.
W. A. CARTER
(with Distinction in Engineering).
G. W. FLETCHER.
P. I. FLETCHER.
M. J. FORD.
P. HOFMEYR.
I. F. JACKSON.
A. A. DE KLERK.
L. G. PARKER.
G. J. PHILLIPS.
B. C. REED.
C. C. STYLE.
C. H. TURNER.
N. T. WALLER.
J. S. WARD.
C. P. E. PILCHER.

After the presentation of Diplomas, the following received prizes:—

W. A. CARTER: "The Farmer's Weekly" Medal for the best all-round student of the Senior Year; and
the African Explosives Prize for Farm Project and Oral.

M. J. FORD: the Lilford Shield for the best practical student in all subjects.

N. T. WALLER: the Lilford Medal for leadership.

G. J. PHILLIPS: the Barrett Shield for proficiency in clean milk production.

C. P. E. PILCHER: the Stewarts & Lloyds Prize for practical engineering.

J. R. TATTERSFIELD: the Imperial Tobacco Company's Shield for the best all-round student of the Junior Year;
the Fisson Ltd. Prize for Basic Science; and
the William Bain & Company's Prize for the runner-up in the Engineering Project.

S. C. PENNY: the Friesland Cup for cattle judging.

A. S. HOLLAND: the William Bain & Company's Prize for Engineering Project.

M. A. J. BAILEY was also presented with the Friesland Cup which he had won last year but not received previously.

ERRATA.

1. In the March-April "R. A. J.," 1951, p. 167, under "B"

   "*B. spiciformis* umBuze
   B. tamarindoides iGondi"

   should read

   "*B. spiciformis* iGondi
   B. tamarindoides umBuze."

2. In the May-June "R. A. J.," 1951, p. 264, *Parinari mobola.* Oliv.

   "Native Names: Muchacha"

   should read

   "Native Names: Muhacha."

Notes on Freshwater Fishes in Southern Rhodesia

A Catalogue of Some of the More Common Species.

By R. A. JUBB, B.Sc.

Sub-Order SILUROIDEA or Catfishes.

The silurid catfishes are scaleless fishes with three or four pairs of long barbels about the mouth; this latter characteristic no doubt accounts for the common name "barbel" that has been given to these bewhiskered fish. Members of this group include the huge "Vundu" of 80 lbs. and over, and the minute *Leptoglanis*, whose weight is but a fraction of an ounce. The larger species are of some economic value, as they provide wholesome food for the African, but, in enclosed waters they are a nuisance. Certain species possess accessory breathing organs which enables them to remain out of water for long periods.

Family BAGRIDAE.

To those who know the "Kampango" (*Bagrus meridionalis*) of Lake Nyasa, a sporting fish of some merit, it will appear strange that our common rpresentative of this family is a fish barely two inches in length. No other species have, so far, been collected locally.

Leptoglanis rotundiceps. Hilgend. Fig. XXII. Dwarf Catfish.

Distribution.—In the adult stage this fish does not exceed two inches in length and, probably due to this, its presence in the Zambesi and the Sabi River systems has remained undetected until collected recently in the Hunyani River, near Salisbury, and the confluence of the Sabi and Rusawi Rivers. This species was first discovered in the Bubu River, Tanganyika, and has since been reported from the Congo River system.

General Description.—A very small fish, one to one and three-quarter inches in length, found in scattered shoals in shallow water with sandy bed, easily mistaken for fry of some catfish. A closer examination reveals two dorsal fins, the anterior near the head with one spine and five rays and an adipose dorsal fin above the anal fin. The fish, which is dirty white in colour, is covered with large irregular dark brown spots on the dorsal surface and along the sides. Looking from above, the maxillary barbels are prominent and also the spines of the pectoral fins.

Family SCHILBEIDAE.

Small dorsal fins and very long anal fins are characteristic of the two genera represented in our rivers.

Schilbe mystus. Linnaeus. Fig. XXIII. Butter-fish or Silver barbel. Native Name:

Fix. XXV.—Squeaker. *Syndontis zambesensis.*
(Gilchrist and Thompson after Boulenger.)

Fig. XXVI.—Dwarf Catfish. *Chiloglanis neumanni.*
(After Boulenger. By courtesy of the British Museum.)

Fig. XXII.—Dwarf Catfish. *Leptoglanis rotundiceps.*
(After Boulenger. By courtesy of the British Museum.)

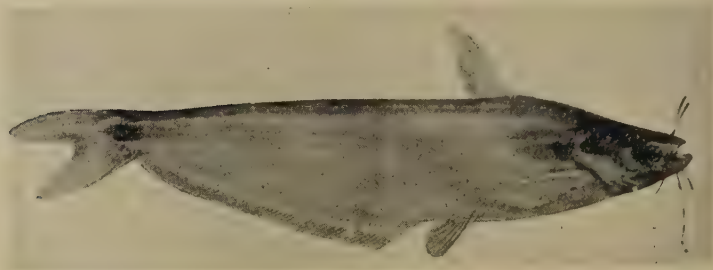


Fig. XXIII.—Silver Barbel. *Schilbe mystus.*
(Gilchrist and Thompson after Boulenger.)

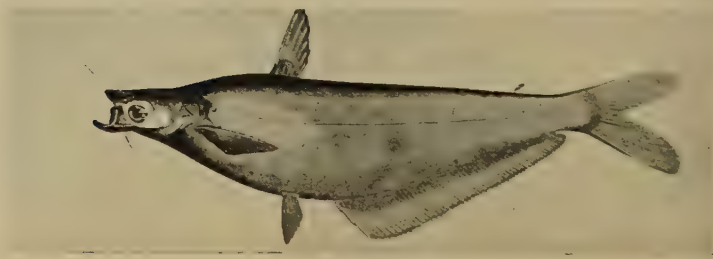


Fig. XXIV.—"Makreel" or Silver Barbel. Note adipose fin. *Eutropius depressirostris.*
(Gilchrist and Thompson after Boulenger.)

Distribution.—With the Zambesi River as its southerly limit and excluding Lake Nyasa, this fish has a wide distribution in Central Africa. It is common above and below the Victoria Falls and at Chirundu Bridge.

General Description.—In length it does not exceed twelve inches, and is very light in colour with a broad darkish lateral band. The droop of the tail is characteristic, and this species is distinguished from the next by the absence of an adipose dorsal fin. Although small, this fish is of great food value and is eagerly sought after by Africans for its fat; the flesh is edible and of good flavour. Being a predator, it will take earthworm, liver or fish flesh as bait.

Eutropius depressirostris. Boulenger. Fig. XXIV. Silver Barbel, but known along the Limpopo as "Makreel." Native Name: Liluma (Beit Bridge area).

Distribution.—Apart from the Limpopo River system this fish is not at all common in Rhodesia. It is reported from Lake Nyasa, the Lower Zambesi, and some East African Rivers, but has not been found in the Zambesi River system above the Victoria Falls.

General Description.—Very similar to the previous species described, *Schilbe mystus*, but recognised by the small adipose dorsal fin. Here again, the flesh is edible and of good flavour. Reported by F. Sheppard to be plentiful in the Limpopo River and up to fourteen inches in length.

Family MOCHOCIDAE.

A widely spread genus of this family is *Synodontis*; species are to be found in freshwaters from the Zambesi to the Nile. In this latter River *Synodontis batensoda* and *Synodontis membranaceus* have the peculiar habit of swimming upside down and their coloration alters accordingly, the belly becoming dark and the dorsal surface light. Periodically they appear to find this position uncomfortable and swim about in a more fish-like manner accompanied by a reversal of coloration.

Synodontis zambesensis. Peters. Fig. XXV. Squeaker or Grunter. Native Name: Horro-korro or N'kolo kolo.

Distribution.—Although there are several species of *Synodontis*, including the spotted varieties such as *S. melanostictus* and *S. jallae*, to be found above the Victoria Falls, *S. zambesensis* is the only one found commonly in the Zambesi system below the Falls. From the Zambesi northwards it has a wide distribution in the rivers and lakes of Central Africa. No specimens have been taken or seen taken from the Sabi River or any of its tributaries, but anglers report its presence; confirmation of this will extend the distribution fairly considerably.*

General Description.—A fish of eight to nine inches in length, with light yellow-green underparts and dark brown-green dorsal surface. The tail is deeply forked and the head well armoured. The three pairs of barbels are long, the outer mandibular pair being branched.

* Specimens, undoubtedly *Synodontis* sp., have been collected from the Limpopo River by F. Sheppard and are awaiting diagnosis.

The sharp serrated spine of the anterior dorsal fin and each of the pectoral fins is conspicuous and, being poisonous, can inflict a painful wound. When danger threatens, these spines can be locked at right angles to the body, and anglers have reported finding young crocodiles and even tiger-fish with these formidable spines in their throats. On being removed from the water the struggling of the fish is accompanied by a grunting or sqeaking noise which is actually the creaking of the spines in their sockets.

The "Squeaker" is a predator and a scavenger and, from an angling point of view, is a positive nuisance. The flesh is not eaten by Europeans, and the Africans along the Zambesi River do not appear to be particularly interested.

Chiloglanis neumanni. Boulenger. Fig. XXVI. Dwarf Catfish.

Distribution.—Another small species, originally discovered in the Bubu River, Tanganyika, that has come a long way to be recorded for the first time from the Zambesi River system. It is not commonly seen except at flood periods, when numbers can be found ascending the weir wall below the Prince Edward Dam, Hunyani River. They avoid the strongly running water and ascend the damp splashed edge, holding on to the wall with their mouths and pushing themselves upward with the strong spine of the pectoral fins. Specimens are taken with great difficulty as, at the slightest alarm these small fish fling themselves back into the torrent.

General Description.—No need for arm-stretching here, as the really big ones are two inches in length and the fish is rarely seen unless you look for it. The colour is uniform dark slate with slightly lighter underparts, and is particularly hard to see when against dark rock or green slime. The first specimen was obtained through the assistance of a "Hammerkop" (*Scopus umbretta bannermani.* This bird, as close to the rushing water as possible, was taking what appeared to be tadpoles from the edge of the weir; careful investigation proved the diet to be young *Labeo* and *Chiloglanis neumanni.* Without this help these small fish would not have been detected.

Since compiling the above notes the following information has been received from the Director of the Transvaal Museum. Our records show the following species of *Synodontis* to have been recorded from the Limpopo River and its tributaries:—

S. melanostictus. Pienaar's River at Hamanskraal; Olifants River at Loskop.

S. woosnami. Limpopo River at Messina.

S. zambesiensis. Limpopo River at Messina, Pefuri and Chai Chai.

Kingfishers.

By CAPTAIN G. L. JAMES,

Hon. Ornithologist, Queen Victoria Museum.

This family is well known on account of its beautiful colours.

The Kingfishers are usually solitary birds, although it may happen that the two parents are seen in company or that the whole family sits upon the same branch.

In many parts of England there is a singular idea which appears to have its origin in mythical history. In some rural districts a kingfisher may be noticed suspended by the point of the beak from the beams of the ceiling. If you ask the object of this custom, you will learn that the bird always turns its breast towards the quarter from which the wind is blowing. The bird is not stuffed, but various spices are placed in its interior after the viscera has been removed, and the body dried by exposure to the sun.

The expression "Halcyon Days," used to denote a season of special security and joyousness, is derived from an old fable, that the Halcyon or Kingfisher made its nest on the surface of the seas and possessed some innate power of charming the waves and wind to rest during the time of incubation. Fourteen days of calm weather were in the power of the Kingfisher, or Alcyonë, who was the fabled daughter of Æolus, wearing feathered form in token of grief for the loss of Ceyx, her husband, and said to have derived her authority from her father, the Lord of the Winds.

The nest of the Kingfisher, except the striped variety, which nests in hollow trees, is always made in some convenient bank. It is found that the tunnel slopes gently upwards for about three feet and that the bird has shaped a round chamber to contain the parent, nest and eggs. The nest is usually imbued with an offensive odour.

The eggs are white, showing a pinkish tint until cleaned, and are glossy and globular. The clutch varies from three to five.

Their diet consists of small fish, supplemented by small reptiles, batrachia, shrimps, small crabs and insects. Some species have adapted themselves to an insectivorous diet and may be found far from water.

The Pied Kingfisher. *Ceryle r. rudis.*

This member of the family, so well known for its wealth of colour, is, as its name implies, black and white. It is widely distributed over the Colony, and is to be found wherever there are open streams, rivers and lakes. It has the habit of hovering with bill pointed downwards, as though taking aim before it drops with a loud splash into the water, sending up a shower of spray. It emerges a moment later with a small fish or, having missed it, moves on to try again. When a fish is caught, it is carried to a

tree and bashed against a branch before being swallowed head first. Fish are usually caught crosswise in the bill, tossed into the air and caught head first. Their diet consists of small fish, frogs and crustacea.

The eggs average 28.5-30 x 22-23.5 mm. and are laid during October/November.

The Giant Kingfisher. *Megaceryle m. maxima.*

Although it is found in most parts of the Colony, it is nowhere common, seldom more than a pair being seen on the larger rivers, lakes and dams. It is often seen perched low down on an overhanging branch, rock or post, from which it dives down on its prey. Its diet consists of fish, but it also consumes crabs and other water animals. It is not looked upon with favour where imported fish have been introduced, but, as they have never succeeded in destroying the indigenous fish, there seems to be no grounds for alarm.

The entrance tunnel is aproximately eight feet long.

The eggs average 44.5 x 36 mm. and are laid during August-September.

The Half-Collared Kingfisher. *Alcedo semitorquata.*

This species prefers the larger rivers or streams and is the least common of our Kingfishers. It perches low down on a branch overhanging water, from which it watches for its prey, which consists of fish and other water animals.

It lays a clutch of 4-6 eggs averaging 23-24.5 x 20-21 mm.

The Malachite-Crested Kingfisher. *Corythornis c. cristata.*

This is to be seen on most rivers, streams and marshes, particularly those with reed beds. It perches low on any convenient perch from which to dive on its prey, which consists of small fish and other water animals. When disturbed it darts away, flying swiftly over the water, almost touching it. It lays a clutch of 4-5 eggs in September-October, and the eggs average 18-19 x 20-21 mm.

Natal Kingfisher. *Ispiduia picta natalensis.*

This bird is found on most waterways, but at times it can be found some distance away. Dead ones are often picked up in gardens, usually having been killed by flying into windows. Three have been sent to me at various times for the Museum. This would point to their being local migrants moving from stream to stream, or that they are intermediate between the true fish-eaters and those that have become insectivorous; thus at times leaving the water for an insect diet inland. Dr. Roberts states in his "Birds of South Africa" that they subsist entirely on insects, but I have often seen them on our small streams, but have never seen one catch fish.

The clutch of 4-6 eggs, which average 17.8-18 x 15.3-16 mm., is laid in September-October. The nest is usually situated in sandy soil.

Kingfisher

Angola Kingfisher. *Halcyon senegalensis cyanolencus.*

This is a tropical species found in the low country. It is insectivorous, living on insects taken on the ground. It is usually found in trees along river banks.

The Grey-Hooded or Headed Kingfisher. *Pseudhalcyon p. pallidiventris.*

This species is widely distributed, but is nowhere common, and will be seen in wooded country often at considerable distances from water. They have adapted themselves to an insectivorous diet consisting of grasshoppers, grubs, crickets, beetles, etc., which are taken on the ground.

The species is easy to recognise, and if seen in the garden should not be destroyed. They will not interfere with gold fish. Their presence in gardens should be encouraged.

The eggs, four in number and averaging 25-25.3 x 21.3-23 mm. are laid in October-November.

The Brown-Hooded or Headed Kingfisher. *Chelicutona a. albiventris.*

This species is common, being found in most areas, usually not far from water, although it does not dive for fish but subsists largely on insects captured on the ground. They associate in pairs, and are partial to wooded areas along the banks of rivers and streams. If undisturbed, they will make their home in plantations, orchards, and trees around homesteads, and render excellent service.

In my experience, the nest is usually to be found in a river bank, and is of the usual kingfisher type. It lays 4-5 eggs measuring 27-29 x 24-25.5 mm. in October-November.

The Striped Kingfisher. *Chelicutia c. damarensis.*

This species is widespread but not common, and is to be found in large trees away from water. It feeds on insects found on the ground. This species nests in holes in trees, usually in deserted nests of the Barbets and Woodpeckers. It lays 4-5 eggs, measuring 24-25 x 21-22 mm.

Notes on Indigenous Trees and Shrubs of Southern Rhodesia

Cassia singueana Del.
(Caesalpinaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: ——— . **Native Names:** Mukunda (Chis.); isihaga (Sind.)

General Description.—This is a common shrub or small tree occasionally found up to a height of about 20 feet. The leaves are pinnate and consist of 5-10 pairs of short-stalked opposite leaflets which are usually notched at the tips. The base of the main leaf stalk is distinctly swollen, and on it at each pair of leaflets there is a gland. There are stipules, but tlese fall off fairly early. The bright yellow, sweet-scented flowers, which appear mainly during the dry season when the tree is leafless, are in clusters and very showy. The fruits which, like the flowers, occur in bunches are narrow, slightly rounded, constricted, and curved pods. These are up to 6 inches in length and contain a number of seeds. It has dark-coloured, rough bark.

Distribution.—This cassia is widely distributed as a scattered tree at medium elevations in Southern Rhodesia. It also occurs in territories immediately to the north.

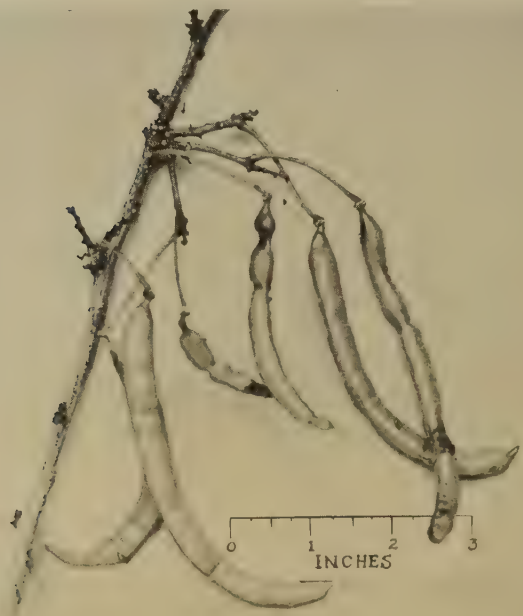
Uses.—This tree is not known to have any special uses. It is, however, very ornamental and worth cultivating from this point of view, although when leafless and not in flower it is, on account of its rather dark bark, somewhat unattractive.

Cassia singueana.
Habit photo.
Tree in full flower.

Cassia singueana.
Leaves.

[Photos. by A. A. Pardy.

Cassia singueana.
Flowers.



Cassia singueana.
Pods.

[Photos. by A. A. Pardy.

Dombeya rotundifolia Harv.
(Sterculiaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: Dombeya, plumblossom tree. **Native Names:** Mutoranundu, mutongatowa, musiyasitu (Chis.); umuwane (Sind.)

General Description.—During August and September this tree, which, although usually small, may reach a height of about 25 feet, is very conspicuous on account of its masses of white flowers. The flowers fade to pink and brown fairly soon but persist for a long time on the trees. As they fade the new leaves appear. These are simple, alternate, exstipulate and stiff. As the specific name rotundifolia suggests, they are of a round shape. They have small star-like hairs on both the upper and lower surfaces. The veining is palmate and is very conspicuous on the lower surfaces. The small, white, scented flowers at the ends of branches are much visited by bees. The fruits are small round capsules. The thick rough bark is of a dark colour.

Distribution.—The Dombeya is widely distributed as a scattered tree, mainly in the medium altitude areas in this Colony, and is an associate of several types of tree vegetation. It is also found in adjoining territories.

Uses.—The strong, heavy, greyish, durable wood is seldom straight enough to be of much use, but when of suitable sizes it is useful for the manufacture of naves, felloes and yoke skeys.

It is a very pleasing ornamental tree, especially when planted near Kaffirboom trees which flower at the same time.

It can be raised fairly easily from seed.

Dombeya rotundifolia.
Habit photo.

Dombeya rotundifolia.
Leaves.

[Photos. by A. A. Pardy.

Dombeya rotundifolia.
Flowers.

[Photo. by A. A. Pardy.

Heeria reticulata (Baker f.) Engl. (Anacardiaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: ——— . **Native Names:** Murungu, mugaragungu, mubedu (Chis.); isafice (Sind.)

General Description.—This is usually a small and much-branched tree. It contains a resinous juice. The leaves, which are without stipules, are commonly in whorls of three but are sometimes alternate. They are rather variable. In shape they are oblong to lanceolate, are up to about 4½ inches in length and are 3-4 times longer than broad. The upper surfaces of the leaves are sometimes shiny and sometimes have a velvety covering of hairs. The under surfaces are covered with fairly white velvety hairs. The mid-rib and parallel veins are very prominent on the lower surfaces. The petioles or leaf stalks are very short. The flowers, which appear mainly during October and November, are in whitish and small but many-flowered bunches. The flowers are male and female. The fruits are small flattened oblique drupes which are black and wrinkled like raisins when ripe. The bark is of a darkish colour and rairly rough.

Distribution.—*H. reticulata*, as a scattered tree, is common at medium elevations. It also occurs in adjoining territories.

Uses.—As the tree is usually small and branching, the timber is not considered to be of much value.

Heeria reticulata.
Habit photo.
[Photo. by R. Hunt.

Heeria reticulata.
Leaves, flowers and fruits.
[Photo. by A. A. Pardy.

Lannea discolor Engl.
(Anacardiaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: ——— . **Native Names:** Mushamba, mushamva (Chis.); isigangatsha (Sind.)

General Description.—This is a small tree which seldom exceeds 25 feet in height. It loses its leaves early in the dry season and new leaves appear during October. The leaves, which are somewhat clustered on the swollen branchlets, are alternate, imparipinnate (i.e., composed of several leaflets, which in this case are in 3-4 opposite pairs, and with an odd leaflet at the end) and without stipules. The young leaves are soft and covered with pinkish-brown hairs, which disappear from the upper surfaces of mature leaves. The lower surfaces of mature leaves are covered with short grey hairs. The leaflets have rather rounded bases and pointed tips. The flowers, which appear during September before the leaves, are in the form of striking yellow catkins up to 4 inches in length. The male and female flowers are usually on different trees, the catkins of the male flowers being longer than those of the female flowers. The fruit is a hairless drupe about the size of a large pea and contains one seed embedded in a grape-like pulp. The small "horns" on the fruit make it look rather like a very minute sea mine. The fairly smooth to rough bark is of a dark grey colour and the inner bark is gummy.

Distribution.—*L. discolor* is common as a scattered tree mainly at medium elevations in this Colony and is associated with several types of tree vegetation. It also occurs in adjoining territories.

It should be mentioned that there is some doubt as to the correct naming of the tree. It resembles *L. schimperi* (Hochst. ex A. Rich) Engl. in many respects and may prove to be this species.

There is another common and widespread species of *Lannea*. This is *L. edulis* (Sond.) Engl., which is a low shrub seldom more than about a foot high. The leaves, flowers and fruits resemble those of *L. discolor*.

Uses.—*L. discolor*, which has a soft, light wood rather like poplar, has no special uses other than that the fruit is edible and, as it strikes readily from truncheons, it is useful for live fences and establishment for shade and ornament. The fruit is eaten by several species of birds, including the golden oriole, Jameson's weaver, and plum-coloured and redwing starlings.

Lannea discolor.
Habit photo.

Lannea discolor.
Male (long) and Female (short) inflorescences.
[Photos. by A. A. Pardy.

Lannea discolor.
Fruits and young leaves.

Lannea discolor.
Fruits and leaves.
(Note typical swelling showing in the case of the fruiting branchlet.)
[Photos. by A. A. Pardy.

Monotes glaber Sprague (Dipterocarpaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: Muwara. **Native Names:** Muwara, mushawa, mubarawashawa (Chis.); inyunya, ilinyunya (Sind.)

General Description.—The muwara is a tree attaining to a height of about 30 feet although it is more commonly rather less than this. The crown is normally somewhat rounded, but sometimes it has a more pyramidal shape. The bole is usually straight. The foliage is of a yellowish-green colour. The stiff leaves, which are up to 3 inches in length, are alternate, simple and have petioles or leaf stalks about ½ inch in length. They are of a somewhat oblong shape with rounded ends and smooth above and rather rough on the under surfaces due to the prominent, distinctive veining. There is a small gland at the base of the leaf blade on its upper surface and there are sometimes a few small scattered hairs on the lower surface. There are stipules or small appendages at the base of the leaf stalks which may fall off early. The flowers, which appear during the rainy season, are of a greenish-yellow colour and occur in few-flowered bunches. The fruits, of a pale brown colour when ripe, hang for a considerable time on the trees. They are round, one or two-seeded nuts surrounded by the enlarged wing-like sepals which adapt the fruits for wind distribution. The brown bark is slightly rough and flaky.

There is another species, *Monotes tomentellus* Hutch. & Milne —Redhead, which sometimes is found growing with *M. glaber* and which is readily distinguished by the slightly different shape of the leaves, their light grey under surface and darker green upper surfaces.

Distribution.—The muwara is common in the medium altitude areas of this Colony and is an associate of several types of tree vegetation. It is of very common occurrence in the Msasa type, and may sometimes be found as a dominant in a small zone on slopes towards vleis. It is also found in territories immediately adjoining Southern Rhodesia.

The genus Monotes is the only representative in Rhodesia of the family Dipterocarpaceae which in the India-Malaya areas contains many important genera.

Uses.—The light reddish-brown timber is fairly hard and close-grained and not readily attacked by insects. It should nevertheless be treated with a preservative, especially if placed in the ground. Either as poles, or timber which has been carefully sawn and seasoned, it can be used for a variety of purposes, ranging from fence posts to door frames and parquet flooring blocks. It makes a good firewood and charcoal.

Monotes glaber.
Habit photo.

Monotes glaber.
Leaves and flowers.
[Photos. by A. A. Pardy.

Monotes glaber.
Leaves and fruits.
[Photo. by A. A. Pardy.

Pseudolachnostylis maprouneifolia Pax (Euphorbiaceae)

By A. A. PARDY, Conservator of Forests (Research).

Common Name: ——— . **Native Names:** Mushozhowa, mushonzhiwa, musonzoa (Chis.); umqobampunzi (Sind.)

General Description.—This is a tree up to 30 feet in height. The simple, alternate leaves are of a somewhat oval shape and about 1½ inches long. Petioles, or leaf stalks, are about ¼ inch long. There are no hairs on the leaves except for a few on the mid-rib below. There are stipules but these fall off early. Prior to falling during the middle or latter part of the dry season the leaves assume very attractive red autumnal tints. The flowers, which appear about the same time as the new leaves during October and November, are male and female. The small yellow male flowers are in small bunches whereas the female flowers are usually solitary. The fruit containing a number of seeds is round, about ¾ inch in diameter, of a yellowish colour and wrinkled when dry. Three faint lines are visible on the fruits where they open. The bark is fairly rough.

Distribution.—This tree occurs extensively as a scattered tree at medium and lower elevations in this Colony and is an associate of several types of tree vegetation. It also occurs in adjoining territories.

Uses.—The wood, of a light brown colour, close-grained and medium hardness, is on account of the smallness and branchiness of the tree, not commonly used. It would be useful for turnery work. It, however, makes a good firewood and charcoal. The calorific value is high. Pounded roots mixed with cold water are said to be used as a cathartic by natives.

Pseudolachnostylis maprouneifolia.
Habit photo.

Pseudolachnostylis maprouneifolia.
Young leaves and male flowers.
[Photos. by A. A. Pardy.

Pseudolachnostylis maprouneifolia.
Young leaves, female flowers, young and mature fruits and seeds.

Pseudolachnostylis maprouneifolia. Leaves and fully-grown fruits.
[Photos. by A. A. Pardy.

Fencing

By THE DEPARTMENT OF NATIVE AGRICULTURE.

1. **Poles.**—As iron straining posts, standards and droppers are difficult to obtain, wood poles have often to be used. To avoid frequent replacement and constant maintenance the poles should be durable and should be correctly treated.

Poles of the following trees are durable and the trees are sufficiently common in different parts of the Colony to supply fencing poles [1].

Mopani	*Colophospermum mopane.*
Mangwe, Mukonono or Msusu	*Terminalia sericea.*
Mukarati	*Burkea africana.*
Mtowa, Musikanyimo, Inkamamasane	*Diplorynchus mossambicensis.*

(This latter tree gives specially straight droppers which are not very subject to Borer attack.)

2. **Treatment of Poles** [2].—The following methods will ensure the longest possible life for the fencing poles:—

Cutting: The top of the pole should be cut at an angle so that rain water is more inclined to run off and less inclined to penetrate. If possible, cut poles in winter when borer damage is much reduced.

Barking: Immediately after felling, the pole should be cut to correct length and the bark removed including the underbark. This eliminates bark borers and hastens the drying out of the pole.

Seasoning: Stack the first layer of poles on stones on an even level surface clear of the ground, e.g., on logs, leaving a space between poles. Stack the next layer at right angles to the first layer and continue in this way until the stack is complete. For every one inch of thin end diameter, the poles require one month to season. Thus three inch thin end diameter poles would take three months to season. Stack in a shady but well ventilated site.

Preservatives [2]**:** These should only be applied after poles have been seasoned. Various preservatives lengthen the life of fencing poles and the cost of treatment is thus recouped.

(A) A mixture of 25 per cent. light oil and 75 per cent. creosote is effective, but heat treatment is necessary for full absorption. The difficulty is that creosote is somewhat difficult to obtain nowadays.

(B) Water soluble preservatives such as zinc chloride and arsenical salts are leached out during rains, and so the treatment becomes less and less effective. Immersion for about a week in a dip tank will preserve the timber to some extent, but the danger of cattle being poisoned by licking the poles is a very real one. Brushing the poles with old oil after any treatment with water soluble preservatives prevents leaching to some extent and lessens the danger to stock.

(C) The use of preservatives of the copper naphthenate and pentachlorophenol type is effective. These preservatives are easy to apply by immersion or brush treatment, they are lasting but they are expensive. Taking the long-term view, they pay for themselves in the longer life of the pole. These preservatives are obtainable in Southern Rhodesia and are sold under various trade names.

3. **Material Required.**—One mile of standard, four-strand fencing will require:—

(1) 4-6 straining posts (7 feet long).

(2) 115 standards (iron) or poles (6 feet long, 3 inches av. diam.)

(3) 345 droppers (iron) or posts (4 feet long, 1½ inch av. diam.)

(4) 16 rolls barbed wire (44 yards to a roll).

(5) 20 lbs. of No. 12 or No. 14 plain wire (No. 14 is better).

(6) Some 8-gauge wire for anchors.

If plain wire is not obtainable for binding, then staples are better than nails for securing the wire to the poles, as nails are more easily removable. If nails have to be used, then 2½ inch nails are best, and they should be driven in below the wire if the wire has to be lifted to the correct height, and above the wire if it has to be pulled down to the correct height.

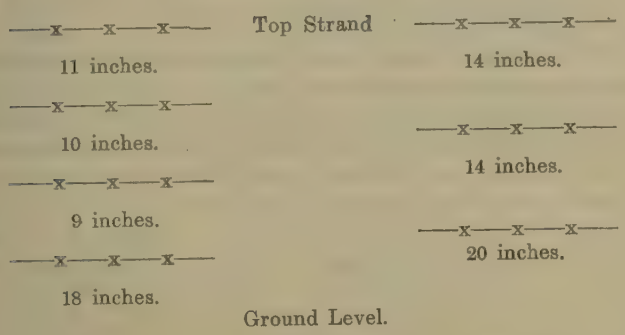
One mile of three-strand fencing requires only 12 rolls of barbed wire (440 yards to a roll), but the same amount of other material.

4. **Specifications.**

Distance between standards or poles	15 yards.*
Number of droppers between two standards or poles	3*
Depth of holes for straining posts	2′ 6″
Depth of holes for poles	1′ 6″
Distance between straining posts.....	300 to 400 yards.

* NOTE.—For first-class, permanent fencing the distance between poles should be 10 yards with two droppers between poles.

Distance Between Wires.



In normal circumstances there is no point in having a five-strand fence under Native Reserve conditions. Indeed, with the present shortage of barbed wire the use of three-strand fencing should be considered. It has been found sufficiently effective where it has been used. Government specifications require five-strand fencing for boundary fences, but iron standards and droppers are also specified for this, and are marked at correct spacing for the wires.

5. **Straining Posts.**—In broken country these should be as close as 300 yards, but in open country they may be 440 yards apart. Avoid straining wire in the very early morning or in cold weather as the wire will break, or if no break occurs it will slack off. Avoid straining in very wet weather, as anchors will tend to give.

6. **Droppers.**—All droppers must be placed so that they do not originally touch the ground. If they are bound to the barbed wire with plain wire, then it is a good plan to place the droppers with the thick end upwards. As the wood shrinks so the dropper is more securely held, and it does not gradually fall and eventually touch the ground. Droppers may be marked at correct wire spacing, and they need not be notched if the correct method of tying is used.

7. **Setting in Poles.**—The tops of poles should originally be cut at an angle to lessen penetration of water and control fungus attack. Bank earth up around the base of the pole for a few inches so that there is no depression in which water collects. Again this is a help against fungus attack.

8. **Fixing Wire on Poles or Standards.**—With the "Bulb-T" standards the wire goes across the flat part of the standard and

is tied through the hole. With the angle standards the wire fits in the slots and is tied from the back.

In using poles a slight notch is useful at the correct espacement, but this notch need not be deep. Use a stake marked at the right distances apart for wires to help get all these notches on the poles at correct distances apart. The tie wire goes round the back of the post, then both ends of the tie wire come above (or both ends below) the strained barbed wire and the ends are then twisted firmly around the barbed wire. This is better than putting one tie wire above and the other below the barbed wire and twisting in opposite directions. Posts may be drilled with a brace and correct fencing or hardwood bits **before** treatment. It must be clearly understood that wires must be attached to posts in the way described above, and not threaded through (as is often done with plain wire) so that replacement of poles can be done easily.

9. **Fencing Across a Depression.**—Place two box anchors on either side of the depression. Then strain wire to a suitable tension, but not too tightly. After straining, tie the wire first to the lowest standard or pole, and at this point interlace wire through the strands of barbed wire and attach this interlaced wire to a heavy stone.

When fencing over a rise or ridge, tie the wire first to the standard or pole at the highest point.

10. **Box Anchors.** (See Sketch 1.)

(I) Cut mortices in poles A and B so that the box pole C fits snugly.

(II) Make a hole for the anchor stone of suitable size, using a stone about 2½ feet in length by a foot in depth and thickness. Let the stone slightly into the bank at the bottom of the hole nearest the straining post. Now dig a small channel at the centre of anchor pole where it enters the ground in direct line with the centre of anchor hole. Take sufficient No. 8 gauge plain wire, i.e., four times the distance from A to B with sufficient to spare for tying, etc. One end of this wire is then passed through hole drilled in post at A, the remainder of the wire is brought down the side of anchor posts, wrapped round the anchor stone and brought up again on the opposite sides of posts and through hole at A. Repeat this procedure with wire still left over so that the ends eventually lodge on opposite sides of post at A. Twist ends securely and neatly to each double wire now protruding from opposite sides of hole in post at A. The anchor stone, after being wired, should rest evenly on the base of hole in the ground.

Having filled anchor hole with soil, tamping firmly, twist double wires together at position X with an iron bar ¾-in·h (approx.) in diameter, drawing the posts towards each other until they are slightly off plumb, so as to make an allowance for the straining which will bring them back to a vertical position. Then remove iron bar, locking the aperture by means of placing a short length of wire through the aperture at X and twisting each end on either side of the aperture to anchor cable.

No amount of stamping will hold the anchor in position. It is the direct pull against the soil that is the secret of a good anchor. Do not overlap the fencing wires at box anchors, but tie the wire from one side just above the wire from the other side. The work of the false or intermediate anchor falls away immediately the section of fence from one box anchor to the next box anchor is complete. It is put in to hold the pole in position while that section of the fence is being completed.

11. **Straining Wire.**—A "Suregrip" wire strainer has been proved to be reliable and effective. Strain the top wire first and tie lightly. Then strain the second wire and tie tightly, and so on with the third and fourth. It may be necessary to re-strain the top wire, and hence the suggestion to tie it loosely. Experienced fencers will be able to get the tensions in the various wires such this it is not necessary to re-strain.

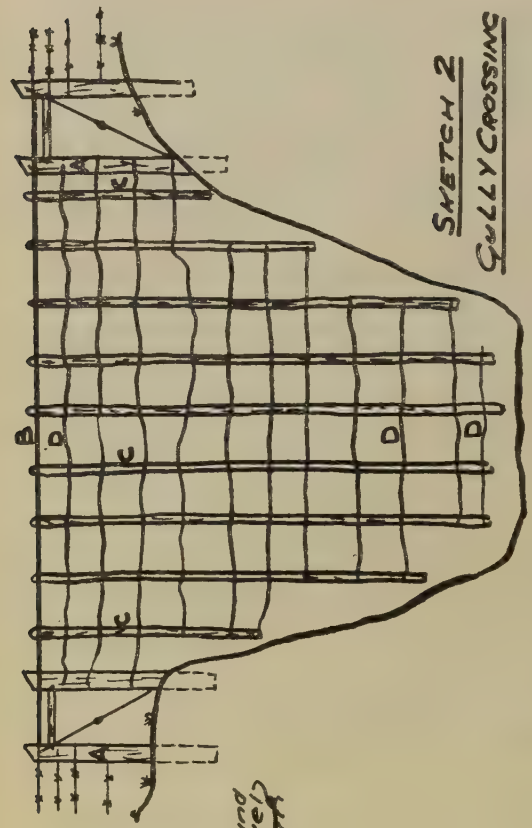
12. **Gully or Stream Fencing.** (See Sketch 2.)—The suspended gate rises and falls with the flow of water. It must be kept clear of debris.

If the flow of water is not very great, then a substantial dry packed rock wall built to within 20 inches of the bottom strand may be used.

In the case of rivers, where these two suggestions are not practical, the only solution is to end the main fences on each bank above flood level. Then erect a temporary fence stretching across the river. This temporary fence is bound to wash away and is replaced each dry season.

For depressions, when straining will lift a pole planted in the centre of the depression, place a heavy stone in the ground at the base of the pole. Drill the pole near ground level and wire the pole securely to the stone.

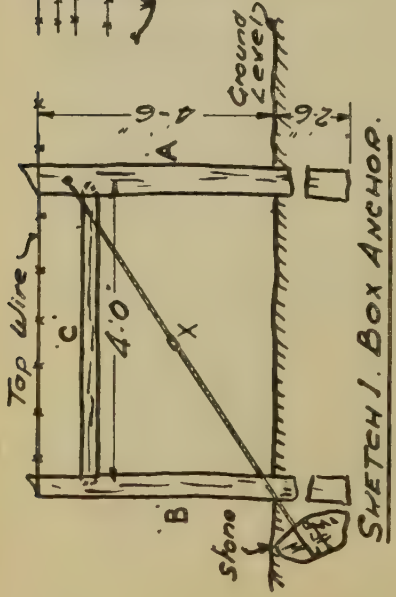
13. **Fencing Across Ruwares or Dwalas.** (See Sketch 3.)—This tripod is easily made from treated bush poles and it is extremely effective. Place one tripod in position at right angles to the line of fencing and at the highest point. Tie the wires to this tripod. Then place any other necessary tripods at the usual distance apart for poles, and tie the strands of wire to these tripods.



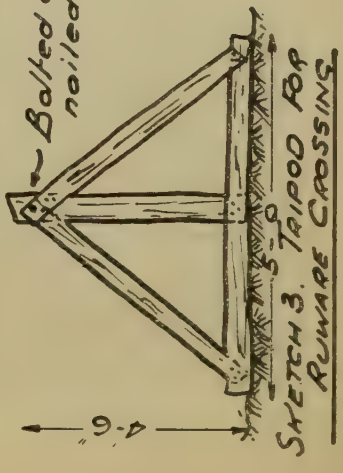
SKETCH 2
GULLY CROSSING

A: Box Anchors carrying fence, to either side of gulley. B: Cable of four to six strands of wire across gulley, twisted after in position
C: Light saplings suspended from cable allowing sufficient clearance at bottom of gulley to move freely backwards and forwards. D: Wire fastened to saplings but not pulled tight.

IRRIGATION DEPT 6.11.8.



SKETCH 1. BOX ANCHOR.



SKETCH 3. TRIPOD FOR RUNAWAY CROSSING

Another method of fencing across ruwares is to drill holes with jumpers and set in iron standards with a cement mixture.

ACKNOWLEDGEMENTS AND REFERENCES.

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Report on the Cattle Cost Investigation Carried Out By the Economics and Markets Branch.

JULY, 1950, TO JUNE, 1951.

INTRODUCTION.

The importance of the cattle industry in the general economy of this country cannot be overstressed. Large tracts of the country especially in the lower rainfall areas cannot be effectively utilised for any other form of agricultural production. In addition, livestock, in particular cattle, are necessary in any system of farming based on arable crops to give it stability and to maintain soil fertility.

The industry has in the past suffered several severe setbacks. The first of these was around 1922, when, after large sums of capital had just been invested in cattle breeding and considerable expansion was taking place, the slump came and production far exceeded demand. Shortly afterwards export to the Union for re-export to Europe and to the Belgian Congo was found possible, and the surplus of slaughter stock was removed and local prices improved. It was not until 1930, however, that sufficient confidence had been restored among European farmers to bring about increased production. Then in the early thirties, when the European cattle industry was again developing, Foot and Mouth Disease broke out and another slump followed immediately. The results were disastrous, no export being possible for nearly three years, whilst local prices dropped to ruinous levels due to a fall in consumption. Farmers and ranchers lost confidence again and the European cattle population decreased by twenty-five per cent. The establishment of the Cold Storage Commission in 1938 and the improvement of world and local conditions marked the turning point and since that date, encouraged by guaranteed minimum prices and improved marketing conditions the cattle industry has been in a fairly healthy position.

Since the last war, however, the country as a whole has been developing at an extremely rapid rate and shortages of staple foods, including meat, have arisen due to the failure of agricultural production to expand at an equivalent rate. A series of drought years from 1946-47 to date has done nothing to improve the situation.

The cattle population has been steadily increasing since 1938, as the figures published by the Central African Statistical Office reveal.

TOTAL CATTLE.

	European Owned.	Native Owned.
1938	739,839	1,555,806
1939	755,728	1,570,310
1940	826,268	1,636,496
1941	851,449	1,768,690
1942	879,144	1,768,010
1943	918,538	1,824,521
1944	956,217	1,915,534
1945	1,001,269	1,911,644
1946	1,020,677	1,884,334
1947	1,038,788	1,709,549
1948	1,109,483	1,712,346
1949	1,188,101	1,815,733

The latest available figures (December 31st, 1950), however, show an appreciable decrease in the numbers of European owned cattle (to 1,148,712 head). The effect of the drought years can be seen in the reduced number of calves—167,000 as against 199,000 at December 31st, 1949, and the trend of the last few years in the reducing numbers of trained oxen has continued, the numbers having fallen by 18,000 head. Untrained oxen have increased by 15,000 head and native cattle stand at 1,832,415 head.

Long-term price and market guarantees to give essential stability to the industry are imperative, owing to its importance and the fact that it is a relatively long-term type of production. Without such guarantees, the uncontrollable risks of disease epidemics and adverse seasons to which ranches are exposed discourage new entrants from entering the industry and established producers from expanding production. The necessity for any guaranteed prices to be soundly based on production costs was soon realised in the course of the discussions between the Government and the Rhodesia National Farmers' Union Cattle Committee, which led up to the Cattle Price Agreement.

Accordingly the Economics and Markets Branch initiated a costings survey in July, 1950. The techniques to be employed in the costings were fully discussed with the Rhodesia National Farmers' Union Cattle Committee, who furnished the Branch with the names of suitable farmers and ranchers who were willing to co-operate in such an investigation. Just over 80 farmers were contacted and the majority commenced keeping the necessary records. Unfortunately, for one reason or another, a considerable number failed to complete these records for a full year and costings were obtained from 33 farmers. This "drop out" was more than can normally be expected and is not too encouraging, but is probably due in part to the restricted number of visits paid to the co-operating farmers due to the acute staff shortages experienced by the Branch. It is hoped that this position will be rectified in the near future.

The sample obtained, even though considerably smaller than originally intended, represents most of the cattle-producing districts and systems of production. It will therefore serve satisfactorily as the basis for a cost structure from which changes in the cost of production can be calculated. Previously a theoretical cost structure, made by the Thomas Commission and the R.N.F.U. Cattle Committee, has been used in price discussions. This cost structure gave the following relationships between price and cost increases, using 1938 as the base.

Year.	Straight Price Index.	Weighted Price Index.	Cost of Production Index.
1938	100	100	100
1943	110	135	137
1944	124	150	140
1947	138	158	172
1948	171	211	214
Interim minor adjustments made	189	—	—
1949	213	239	256
1950 (Devaluation October, 1949)	—	247 (½ year old price, ½ year new.)	—

Weighted prices are the average of the prices received by producers based on actual deliveries grade by grade and month by month.

The bonus of approximately 10 per cent. paid from 1943 onwards has not been included in these figures.

It will be seen that prices have lagged only slightly behind cost prices over this period, though this does not mean that profit margins have been satisfactory, as the relationship between costs and prices, in the base year 1938 are not known. There is certainly evidence to suggest that new entrants have not been attracted into the industry to a sufficient extent to compensate for the increase in demand. The amount of capital necessary for cattle production on a reasonable scale, especially taking into consideration the inflated price of land now ruling, must have deterred many potential cattle producers who have preferred other enterprises giving better and quicker returns.

Whilst prices must be made sufficiently attractive to encourage new entrants and increased production, it is doubtful whether economic justification can be found for encouraging productive systems which have to carry interest charges on unrealistically inflated land values. Cattle production is essentially a long-term type of production, and prices must not be studied from a standpoint of immediate requirements alone but their implications on future development must always be borne in mind. Thus, whilst prices must give the established producer a fair return and encourage increased production to meet the increased shortfall

expected during the next few years, they must not be allowed to stimulate uneconomic enterprises and must also take into account the fact that a large proportion of the demand will always be for the lower grades of meat due to native consumption requirements.

The Departmental Working Party on Meat Supplies estimated the shortfalls for the next three years as below:—

Year.	Stock Shortfall.	Beef Shortfall.	Per cent. Shortfall.
1951	48,000	20,836,000	17 per cent.
1952	64,000	27,648,000	20 per cent.
1953	80,000	35,560,000	25 per cent.

These estimated shortfalls were calculated taking the country as a whole, assuming that the export of beef was totally prohibited and using as a basis the restricted position of 1948. It has been suggested that the shortfall will occur in the European rather than in the Native areas, unless the price for slaughter stock induces a higher rate of sale from the Native areas. There is thus a very strong case for the introduction of short-term incentives (not necessarily price incentives) if an attempt is to be made to bridge the gap betwen estimated future demands and anticipated production.

The Cattle Price Agreement made in 1950 allows for minimum prices for a five-year period with provision for annual negotiations, at which price changes can be discussed where production costs warrant. As seasonal factors greatly influence annual costs, it has been decided that in the interests of stability changes in costs should be calculated by using a cost structure and index figures to reflect any changes in cost of the individual items in this structure. This method has the great advantage of enabling time-lags to be almost entirely eliminated. Provided that the cost structure is sound, and that the index figures are accurately calculated, this method gives an extremely accurate reflection of cost changes. A survey covering one year only can provide a cost structure which will be reasonably accurate, as the seasonal factors will not influence the proportion of the individual items to each other as much as they will either increase or decrease the total cost. It is intended, of course, to correct this cost structure if necessary as the costings data from further years' investigations becomes available.

Thus the costings figures from this first year of the investigation are not to be regarded as giving more than a general indication of the level of costs. The characteristics of the method used are explained fully in Appendix II, and reference is made in the text below to specific points which should always be borne in mind when the costings are being studied.

DISTRIBUTION OF THE SAMPLE.

The sample, which is composed of 33 farmers running an aggregate of 44,951 cattle, covers most of the cattle-producing areas and different types of production. For the sake of clarity and to enable some guarded comparisons to be made between the

districts and systems these averages are given in addition to the overall figures.

Geographical Distribution.

It has not been found practical to relate the different cattle-producing districts entirely to the official district boundaries. With a sample of this size, it is necessary to include a reasonable number of cases in each division, and so in every case a number of Native Districts (or portions thereof) have been grouped together under such a heading as the Eastern Districts. On the other hand, the main provinces of the country include, in some cases, varying systems of cattle management. Mashonaland is an example of this, farmers on the sand veld in the main running breeding herds semi-intensively, whereas stall feeding is practised on red soil farms (breeding herds exist on red soil farms, of course, but none are represented in the sample). The districts used are defined below and will, it is hoped, be clear to the farming community. They are:—

(1) The Eastern Districts.
(2) The Sabi-Lundi Low Veld.
(3) Fort Victoria and Charter Middle Veld.
(4) The Midlands.
(5) Matabeleland.
(6) Mashonaland (sand veld).
(7) Mashonaland (red soil).

(1) The Eastern Districts.

This district covers that part of the country commonly known under this heading, and consists of the Inyanga and Melsetter Native Districts plus that portion of Umtali Native District situated at high altitude and receiving a high rainfall with an appreciable quantity of winter precipitation.

Five farms in the sample are situated in this area, running an average of 1,204 head of cattle (excluding calves).

(2) The Sabi-Lundi Low Veld.

This description covers the Native Districts of Ndanga, Chibi and the southern portion of the Victoria Native District. The altitude is less than 2,000 feet above sea level.

It is represented in the sample by three ranches, all large producers with an average of 6,071 head of adult cattle.

(3) Fort Victoria and Charter Middle Veld.

This is the country lying at between 2,000 feet and 4,500 feet altitude in the Victoria, Chilimanzi, Gutu and Charter Districts.

Three cattle producers in this area co-operated in the survey with an average herd of 3,120 head each.

(4) The Midlands.

The commonly accepted sense of this term is used, including the Gwelo, Selukwe and Insiza Native Districts.

Four of the sample represent this district with relatively small herds averaging 479 head.

(5) Matabeleland.

This heading refers to the Province not included in the preceding district.

Six cattle ranchers from this part of the country are included in the sample, running an average of 790 adult cattle.

(6) and (7) Mashonaland.

This description again refers to the Province, excepting these parts of it included in some of the districts listed above. The farmers co-operating in the costings investigation have been classified according to soil type-sandveld as against red soil, as it was found that on the sand veld cattle were being run largely on the veld (though some winter feeding was practised), whereas the red soil farmers in this survey were stall feeding.

Ten farmers are included in the first classification and two feeders in the latter. They had 380 head and 454 steers respectively.

The distribution of the sample by district can be summarised in tabular form.

TABLE 1.

	Eastern Districts.	Low Veld.	Fort Victoria.	Midlands.	Matabeleland.	Mashonaland, (Sand Veld).	Mashonaland, (Red Soil).	Total.
No. in Sample	5	3	3	4	6	10	2	33
Average No. Kept (Adult Cattle)	1,204	6,071	3,120	479	790	380	454	1,362

Distribution According to System Practised.

One of the difficulties in arriving at the cost of producing cattle is the varying methods of management in existence. Whereas with crops the basic methods of cultivation are constant on all farms where they are grown, cattle production can be practised under varying conditions and with various ends in view. Thus, on the one hand, native type cattle can be ranched entirely on the veld and sold as weaners, feeders or direct for slaughter, and, on the other, high grade beef cattle may be kept under conditions of intensive management mainly for the production of bulls and heifers for stud-breeding purposes. The economics of the latter system do not enter into this inquiry.

For the purpose of this report, the following principal types of production are defined: ranching, breeding, cattle in a mixed

farming system, stall feeders and the running of grazers. Ranchers are considered to be extensive producers running relatively large herds as their sole source of income, though some, of course, have small flocks of sheep, for example, but the income from such sources is not appreciable. Breeders practise a more intensive type of production, often with crops and other livestock as a definite supplementary enterprise. Where farmers are described as mixed, the beef cattle are usually subordinate to crops and other stock such as dairy cattle and pigs. The stall feeders are a distinct class, as here cattle are penned or kept in kraals and fed heavily with both concentrates and roughages during the winter period to produce a heavy, high grade carcase at a relatively early age. Graziers run cattle under Cold Storage Commission Grazier Agreements.

If the sample had been larger, an attempt would have been made to further classify producers as to the type of cattle sold, i.e., weaners, feeders or slaughter stock, but until in the region of 100 producers co-operate such a classification would have no statistical significance.

Table 2 shows the distribution of the sample into the above system classification.

TABLE 2.

	Ranchers.	Breeders.	Mixed.	Feeders.	Graziers.	Total.
No. in Sample	12	9	9	2	1	33
Average No. Kept (Adult Cattle)	2,787	577	573	454	242	1,362

To be more representative, the sample should include a larger number of breeders, mixed farmers, stall feeders and graziers, particularly the latter two types, in addition to a general increase in numbers of farmers co-operating. It is hoped that this will be corrected as the investigation progresses, but it appears unlikely that the 1951-2 sample will be any more representative.

Size Distribution.

The distribution of the sample according to the average number of adult cattle kept in 1950-51 is given in Table 3.

TABLE 3.

	Less than	251-	501-	1,001-	2,001-	Over
Average No. Kept (Adult Cattle)	250	500	1,000	2,000	5,000	5,000
No. of Herds in Sample	6	8	10	5	2	2
Percentage	18.2	24.2	30.2	15.2	6.1	6.1
Total No. of Herds (all types) December 31st, 1950.....	3,328	696	306	104	24	15
Percentage	74.5	15.6	6.8	2.3	0.5	0.3

The sample shows a considerable difference from the country as a whole in so far as size distribution is concerned. It should

be realised that these total figures supplied by the Central African Statistical Office include all cattle on European farms (including, of course, dairy stock) as at 31st December, 1950. The apparent discrepancy in regard to the smaller herds is not as serious as might appear at first sight, as it is reasonable to assume that almost all the dairy herds of the country will be included in the two smaller groups, and there are very strong grounds for supposing that the amount of beef produced from many small herds is not in proportion with their numbers, as such cattle are kept mainly to supply trek oxen which are not sold as beef until too old to work. It does appear, however, that the sample is overweighted in so far as the larger sized herds are concerned, but it should be pointed out that these herds do not "swamp" the others in the sample, as when the average costs and the cost structure were calculated each herd was given an equal weight.

PERIOD OF THE COSTINGS.

With one or two exceptions (where full accounts were used), the costings cover the year 1st July, 1950, to 30th June, 1951. Taking the country as a whole, this period cannot be termed a good season, especially from the point of view of cattle production. It was a season of below average rainfall, though grazing was generally more plentiful (but still short) than the preceding year. The effects of the series of seasons of low rainfall made the overall picture one of shortages of water, grazing and home-grown foods with resulting above normal mortality, reduced calf crops and lower weights and grades of cattle sold. The numbers of sales were, in many cases, above normal, due to the shortage of grazing, though Foot and Mouth Disease restrictions prevented sales in some parts of the country.

Thus the period covered by the costing survey was an abnormal one, and this has had a considerable effect on the results. It can be expected that when more normal seasons are again experienced the costs will show a downward trend (unless this is compensated or eliminated by a continuation of the trend of general costs rises) and that to a lesser degree the structure of the costs will also change.

COSTS OF PRODUCTION.

Full details of the technique used in the calculation of the costs can be found in Appendix II, but in general the method used was that of "enterprise or commodity costing." As results were required as quickly as possible, it was not practical to cost individual bunches of cattle from birth to slaughter. Whilst this method would give more accurate absolute costs, the fact that such an investigation would take at least four years before any results would be forthcoming, ruled it out altogether. The method used, of costing the whole herd for one year and charging these costs against that year's sales (with an adjustment for valuation changes where sales are higher or lower than annual replacement), gives an accurate cost structure though not a true cost of production in a period of changing costs.

Costs calculated on this basis can be satisfactorily used in price determination if it is accepted that time lags between costs

and prices should be eliminated. Thus, in a period of rising costs, the producer will be given prices based on current (or relatively up to date) costs, despite the fact that a considerable proportion of the costs of animals sold were incurred in previous years when costs were lower. In a period of falling costs the converse applies. In practice this position is preferable, as the cattle producer expects his income from one year's sales to cover that year's costs, and if he is prepared to accept paper losses based on absolute costs there can be no justification for not increasing prices concurrently with cost rises. From the angle of consumer prices also, this method is more desirable, for if prices were based on absolute costs, the consumer, who would benefit during a period of rising costs, might not be able to afford prices based largely on costs prevailing in a boom period, at the beginning of a slump, and consumption would fall at the worst possible time or Government would be called upon to subsidise prices in an attempt to maintain demand.

In the costing full allowance has been made for the farmers' own time and interest on capital invested in cattle production, in addition to direct costs and overhead charges.

The overall average of all the herds in the survey are given below. It has not been possible to calculate the cost per 100 lbs. C.D.W. sold for the whole sample, as one-third of the farmers sold no cattle or an insufficient number on which to base such a calculation or did not provide weight and grade information. Thus, this average relates to 22 producers only. The cost per head kept is based on the average of the numbers of adult cattle on hand at the beginning and end of the year.

TABLE 4.

Average Cost of Cattle Production, 1950-51.

	Cost per Head Kept (33 herds, 44,951 cattle).				Cost per 100 lbs. C.D.W. Sold (22 farms, 39,770 cattle).			
	£	s.	d.	%	£	s.	d.	%
Food: Purchased	0	11	11	9.0	0	5	2	5.0
Home Grown	1	9	8	22.2	0	12	9	12.4
Grazing	0	17	4	13.0	0	13	2	12.7
Labour: Native	0	15	4	11.6	0	16	6	16.0
European	0	18	4	13.9	0	18	1	17.5
Dip	0	1	10	1.4	0	1	5	1.4
Veterinary Expenses and Medicines	0	0	10	0.6	0	0	10	0.8
Overheads	0	9	0	6.8	0	6	7	6.4
General Expenses	0	18	10	14.1	1	4	1	23.3
Haulage	0	2	3	1.7	0	1	9	1.7
Transport	0	2	2	1.6	0	3	4	3.2
Herd Replacement	0	5	5	4.1	—0	0	5	—0.4
Gross Costs	6	12	11	100.0	5	3	3	100.0
Manurial Residues	0	6	1	4.5	0	2	9	2.6
Hides	0	1	2	0.9	0	1	7	1.6
Net Costs.....	6	5	8	94.6	4	18	11	95.8

These averages cover all the different districts and types of production and, as can be expected, there is a considerable divergence within the sample. The average costs of the districts and systems of management are given later. This variation in the costs has resulted in the proportions of the items of costs differing between the whole sample used in calculating the cost per head kept and the reduced sample used for determining the cost per 100 lbs. C.D.W. sold. This latter costing should be regarded as giving only a very general indication of costs. It is this cost which is likely to be influenced very largely by the efficiency of the producer and seasonal factors, and within the sample very considerable variations occur.

One of the most striking features of the cost structure is the high proportion of cost attributed to home grown foods. This cost is very high on farms where winter feeding is used, as the sample includes 10 ranchers and breeders who did not show any cost for home grown foods. The question of whether relatively heavy winter feeding is economically justified by heavier weights, better grades and quicker finishing, is one which demands further study, and this Branch will investigate the matter further when more data becomes available. In the meanwhile farmers feeding crops to cattle should give their feeding methods some thought.

Native labour is another very important item of costs; the figure of 15.4d. represents one boy to about 50 head. In the case of the larger herds and where farms are well paddocked economies are possible. The "General Expenses" item may appear to be large at first sight, but it must be remembered that an interest charge on the cattle, buildings and machinery is included under this heading.

The grazing charge, which is primarily an allowance for the capital invested in land and its improvements, shows that the land value, taking the sample as a whole, is in the region of £1 an acre (based on the assumption that the general carrying capacity is about one beast to fifteen acres). Considered in this light, this value is on the high side, as land capable of carrying only one beast to fifteen acres, even allowing for improvements, cannot be expected to give an economic return for capital at that valuation under ranching conditions.

District Costs.

The averages of the seven districts into which the country has been divided for the purpose of this enquiry give very interesting results which are tabulated below.

These district costs show the effects of the economic characteristics of the districts and the systems followed in them.

The Eastern Districts, which have grazing which can almost be termed all year, have low feed costs. As the farms in the sample are fairly well paddocked and conditions are relatively easy for controlling the cattle, native labour costs are on the low side. Their remoteness from railhead is reflected in the high transport cost.

TABLE 5.

Average cost per head kept according to district.

Item.	Eastern Districts (5 Farms, 6,020 Head). £ s. d.	Low Veld (3 Farms, 18,212 Head). £ s. d.	Fort Victoria (3 Farms, 9,359 Head). £ s. d.	Midlands (4 Farms, 1,918 Head). £ s. d.	Matabeleland (6 Farms, 4,738 Head). £ s. d.	Mashonaland Sand Veld (10 Farms, 3,796 Head). £ s. d.	Mashonaland Red Soil (2 Farms, 908 Head). £ s. d.
Food: Purchased	0 3 10	0 1 7	0 2 6	0 12 6	0 0 9	0 8 6	5 12 0
Home Grown	0 5 5	—	0 4 6	0 19 6	0 1 2	3 6 0	4 15 1
Grazing	0 12 11	0 8 1	0 8 7	1 0 9	0 7 7	1 11 3	0 8 0
Labour: Native	0 8 11	0 12 11	0 13 7	0 14 6	0 16 8	1 1 5	0 5 4
European	0 11 1	0 11 0	0 8 5	1 2 2	1 2 6	1 5 4	0 7 8
Dip	0 1 0	0 0 5	0 0 10	0 1 7	0 0 6	0 4 1	0 0 11
Veterinary Expenses and Medicines	0 0 6	—	0 0 1	0 0 5	0 0 3	0 2 1	0 0 3
Overheads	0 4 2	0 6 5	0 6 5	0 9 7	0 3 11	0 11 9	1 8 4
General Expenses	0 13 5	1 0 1	0 17 2	0 15 11	0 15 9	1 4 6	1 0 3
Haulage	0 1 8	0 2 2	0 2 4	0 5 4	0 2 0	0 2 0	0 1 11
Transport	0 3 8	0 3 6	0 0 2	0 5 3	0 2 8	—	0 0 7
Herd Replacement	0 13 8	—0 7 6	1 1 11	0 14 3	—0 6 4	—1 4 3	7 4 3
Gross Costs	4 0 3	2 18 8	4 6 6	7 1 9	3 7 5	8 12 8	21 4 7
Manurial Residues	0 2 5	—	—	0 3 10	0 0 1 x	0 7 1	2 9 9
Hides	0 0 5	0 0 5	0 2 3	0 1 11	0 0 9	0 1 2	0 1 9
Net Costs	3 17 5	2 18 3	4 4 3	6 16 0	3 6 7	8 4 5	18 13 1

	%	%	%	%	%	%	%
Food: Purchased	4.8	2.7	2.9	8.8	1.1	4.9	26.3
Home Grown	6.7	—	5.2	13.8	1.7	38.0	22.4
Grazing	16.1	13.7	9.9	14.7	11.3	18.0	1.9
Labour: Native	11.1	22.0	15.7	10.2	24.7	12.5	1.3
European	13.8	18.7	9.7	15.6	33.2	14.6	1.8
Dip	1.2	0.8	1.0	1.1	0.8	2.4	0.2
Veterinary Expenses and Medicines	0.6	—	0.1	0.3	0.4	1.2	0.1
Overheads	5.2	11.0	7.4	6.8	5.8	6.8	6.7
General Expenses	16.6	34.2	19.8	11.2	23.3	14.3	4.8
Haulage	2.1	3.7	2.7	3.7	3.0	1.2	0.5
Transport	4.6	6.0	0.2	3.7	4.0	—	0.1
Herd Replacement	17.2	-12.8	25.4	10.1	-9.3	-13.9	33.9
Gross Costs	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Manurial Residues	3.1	—	—	2.7	0.1x	4.2	11.7
Hides	0.5	0.8	2.6	1.4	1.2	0.7	0.4
Net Costs	96.4	99.2	97.4	95.9	98.7	95.1	87.9

x Bull Subsidy.

The Low Veld has a very low total per head cost. Low rainfall conditions preclude the growing of feed crops (except with the added expense of irrigation). The only supplementary feeding normally practised under these ranch conditions is to the stud bulls. Transport costs are again high, as this is another remote area. As full accounts were used in all cases, veterinary expenses and medicines have been included in "General Expenses" or with "Dip."

The effects of the bad seasons in the Fort Victoria District are reflected in the heavy cost of maintaining the herds (the "Herd Replacement" item) and the high credit for hides sold from animals which died on the farm.

The heavier feeding practised by the farmers in the Midlands has resulted in higher costs. The increased European supervision arising is a result of a more intensive form of management being practised.

The relatively high cost of European supervision in Matabeleland is probably due to the small size of most of the ranch herds in the sample for this district. Assuming that grazing is available, larger herds would be desirable under these conditions.

The cattle on the Mashonaland Sand Veld have a high cost due to heavy feeding and being run on high cost land. The farms in question are in the main concerned with tobacco production, which has justified the paying of high prices for the farms. The assumption that grazing land is worth a quarter as much as arable was made for the purpose of this costing, and this rate has thrown some of the inflated value of tobacco land, which has changed hands recently on to cattle. Native labour costs appear to be unnecessarily high, and the farmers concerned would be well advised to examine their method of cattle running with a view to reducing labour requirements.

Stall feeding, as practised in some of the Mashonaland Red Soil areas, has an entirely different cost structure to the other methods and also a far higher annual cost per head. The costs of feeding amount to nearly half the total cost, and the cost of purchasing bullocks annually has caused the herd replacement figure to become a considerable cost item. This method of production has a strikingly low labour requirement, which is a point strongly in favour of the development of this method under existing and foreseeable future conditions of native labour shortages. The efficiency of feeding is obviously the main factor determining the profitability of fattening steers.

The Costs of the Differen; Systems of Production.

Table 6 shows the average costs of the different systems of cattle production. No consideration has been given to districts in this classification, though there is, of course, some co-relation between the system and natural conditions, e.g., within the sample stall feeding is only practised in Mashonaland Red Soil areas, and it is doubtful whether much stall feeding can be found except under conditions of good rainfall and fertile soils.

TABLE 6.

Item.	Ranchers (12 cases, 33,445 head).			Breeders (9 cases, 5,194 head).			Mixed (9 cases, 5,162 head).			Feeders (2 cases, 908 head).			Graziers (1 case, 242 head).		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Food: Purchased	0	0	11	0	1	11	0	13	11	5	12	0	0	17	11
Home Grown	0	0	7	0	12	7	3	10	10	4	15	1	1	6	10
Grazing	0	8	0	0	13	11	1	10	10	0	8	0	0	11	4
Labour: Native	0	14	5	0	12	10	1	1	10	0	5	4	0	10	5
European	0	17	3	0	16	6	1	4	10	0	7	8	0	11	2
Dip	0	0	6	0	1	2	0	4	7	0	0	11	0	1	4
Veterinary Expenses and Medicines	0	0	3	0	0	2	0	2	5	0	0	3	0	1	4
Overheads	0	4	3	0	6	7	0	13	8	1	8	4	0	6	5
General Expenses	0	17	2	0	15	2	1	4	7	1	0	3	0	17	4
Haulage	0	1	11	0	1	3	0	3	5	0	1	11	0	6	0
Transport	0	2	8	0	3	4	0	0	3	0	0	7	0	6	3
Herd Replacement	—0	0	4	—0	1	6	—0	10	9	7	4	3	0	4	0
Gross Costs	3	7	7	4	8	11	10	0	5	21	4	7	6	0	4
Manurial Residues	0	0	1x	0	0	8	0	9	0	2	9	9	0	12	3
Hides	0	0	9	0	1	8	0	1	3	0	1	9		—	
Net Costs	3	6	9	4	6	7	9	10	2	18	13	1	5	8	1

Item.	Ranchers.	Breeders.	Mixed.	Feeders.	Graziers.
	%	%	%	%	%
Food: Purchased	1.3	2.2	6.9	26.3	14.9
Home Grown	0.9	14.1	35.4	22.4	22.3
Grazing	11.9	21.2	15.4	1.9	9.4
Labour: Native	21.4	14.4	10.9	1.3	8.7
European	25.4	18.6	12.4	1.8	9.3
Dip	0.8	1.3	2.3	0.2	1.1
Veterinary Expenses and Medicines	0.3	0.2	1.2	0.1	1.1
Overheads	6.3	7.4	6.8	6.7	5.3
General Expenses	25.3	17.1	12.3	4.8	14.4
Haulage	2.9	1.4	1.7	0.5	5.0
Transport	4.0	3.8	0.1	0.1	5.2
Herd Replacement	—0.5	—1.7	—5.4	33.9	3.3
Gross Costs	100.0	100.0	100.0	100.0	100.0
Manurial Residues	0.1x	0.7	4.5	11.7	10.2
Hides	1.0	1.9	0.6	0.4	—
Net Costs	98.9	97.4	94.9	87.9	89.8

x Bull Subsidy.

The increasing intensity from ranchers through to feeders can be seen in this table. The feed costs increase as does grazing (except where feeders are concerned), and the total cost per head also increases. With the limited sample and the short period of the costing, it is not possible to draw any conclusion regarding the relative efficiencies of the different systems.

PROFITABILITY.

The limitations of the costings data do not warrant any detailed study of the profitability of cattle production. It is obvious that a number of uneconomic enterprises are included in the sample. These may be, to a large extent, due to the effects of uncontrollable factors, especially the results of a drought season. There does appear to be a general need for the overhauling of many systems of management to reduce certain items of cost and to improve the weights and grades sold and increase efficiency.

Details of Sales.

Grades.—The majority of the co-operating farmers furnished the Branch with full information regarding the grades, C.D.W.'s and prices received for sales to the Cold Storage Commission, and details of the types, ages and prices received for other sales. The average percentage of grades sold (calculated on the basis of numbers of head not respective weights) was:—

	%
Rhodesia Best	0.8
Imperial	17.8
Standard "A"	29.7
G.A.Q.	37.7
F.A.Q.	11.1
Compound	1.4
Inferior	0.9
Reject	0.1
Condemned	0.5
	100.0

This distribution of grades must be quite close to the overall grading of European stock by the Cold Storage Commission, though it has not been possible to confirm this as the Cold Storage Commission do not publish separate figures for European and Native cattle. If anything, the results may be slightly better than the overall picture.

Weights.—The average C.D.W. per head sold was 476 lbs. The average C.D.W. for the total stock slaughtered by the Cold Storage Commission during 1950 was 415 lbs., so that the average of the sample is probably only slightly in excess of the overall

average for European stock slaughtered by the Cold Storage Commission. This does not mean that this figure can by any means be regarded as being satisfactory. The highest weight (577 lbs.) was, as can be expected, recorded by a feeder though several ranchers came very near to this figure. The lowest weight was 339 lbs. by a rancher.

Prices.—The average price received per 100 lbs. C.D.W. by farmers in the sample was 75s. 1d. This includes a small number of sales not to the Cold Storage Commission, where the C.D.W. was estimated. This figure cannot safely be compared directly with the average cost per 100 lbs. C.D.W., but it does suggest there is some loss taking the sample as a whole.

CAPITAL INVESTED.

The importance of capital charges and the considerable sums invested in cattle production warrant a brief study being made of this side of the cost picture. Table 7 presents the average annual capital charges per head kept. This charge has been calculated at 5 per cent. of total investment of capital for cattle production.

TABLE 7.

Average Capital Charges per Head Kept.

	£	s.	d.	%
Land	0	10	9	32.7
Buildings	0	1	8	5.1
Fencing	0	2	7	7.9
Dams	0	0	5	1.3
Boreholes	0	0	5	1.3
Other Land Improvements	0	2	8	8.1
Machinery	0	1	8	5.1
Cattle	0	12	8	38.5
	1	12	10	100.0

Thus the capital invested in the cattle themselves represents the heaviest capital charge, followed closely by land and the other capital brings up the total charge to just under a quarter (24.8 per cent.) of the total gross costs of production. This proportion is lower than the estimate made by the Thomas Commission and R.N.F.U. Cattle Committee, in which capital charges were taken as being half the total cost, and this suggests that running costs have been increasing at a more rapid rate than the overall capital charge increase due to new entrants buying land, machinery, etc., at present-day prices.

These charges indicate that the capital invested per head is about £32, which is a very considerable figure, and means that in round figures just over £30 million is invested in the cattle industry in this country.

Returns on Capital Invested.

The information available at present is not considered adequate to make any study of the returns on capital given by cattle production.

SUMMARY.

(1) The costings refer to 33 farms running a total of 44,951 head of adult cattle, representing most of the cattle producing districts of the country and the different systems of production. The period costed was July, 1950, to June, 1951.

(2) Net costs average £6 5s. 8d. per head kept and about £4 18s. 11d. per 100 lbs. C.D.W. sold and include an allowance for the farmers' own time and interest on capital.

(3) The costings of the districts and systems showed that the average cost per head in the ranching areas was relatively low and that costs increased under more intensive management, due principally to the cost of feeding and also to increased land values reflected in the grazing charge.

(4) The grades sold by the co-operating farmers appear to be representative of the overall picture of European sales, and the average C.D.W. was 476 lbs. The average price received was 75s. 1d.

(5) The capital invested per head was about £32, and the charges on this accounted for just under a quarter of the total cost.

(6) It must be emphasised that these costs refer to a small sample and one year only.

They should therefore be treated with reserve and too many conclusions (especially with regard to profitability) should not be made from them.

ACKNOWLEDGEMENT.

Grateful acknowledgement is made of the assistance of the R.N.F.U. Cattle Committee and of the cattle producers who took part in this investigation, supplied the necessary records and other information, and in many cases made their full accounts available to the Branch, and gave the field workers considerate attention and hospitality on the occasion of their visits.

The R.N.F.U. Cattle Committee has given invaluable support to the Branch by, in the first instance, supplying it with a list of cattle producers who were willing to co-operate, and later by taking a considerable interest in the progress of the inquiry. Special mention can be made of the Chairman, Mr. E. MacArthur, and Mr. I. H. de la Rue, with whom the officers concerned had many valuable informal discussions.

The initial field work in connection with the costing survey was performed by Mr. A. A. N. Perioli, and the final collection, analysis and tabulation of the data by Mr. R. Anderson who also compiled the report. Assistance on technical points was given by the Chief

APPENDIX I.

CATTLE COSTS, 1950-51.

Code No.	System	Average No. Kept	COST PER HEAD KEPT: FOOD: Purchased	FOOD: Homegrown	LABOUR: Grazing	LABOUR: Native	LABOUR: European	Dip	Vet. and Medicines	Overheads	General Expenses	Haulage	Transport	Herd Replacement	Gross Farm Costs	Manurial Residues	Hides	Net Farm Costs	Net Cost per 100 lbs. C.D.W.	PERCENTAGE GRADES SOLD: R.B.	IMP.	A.	G.A.Q.	F.A.Q.	COMP.	INF.	REJ.	COND.	Average C.D.W.	Average Pr. o per 100 lbs C.D.W.
C.			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	%	%	%	%	%	%	%	%	%	lbs.	£ s. d.
1	Ranching	14,270	—	—	0 8 6	0 8 9	0 6 2	0 0 8	—	0 1 1	1 4 5	0 2 11	0 0 4	−0 10 11	2 1 11	—	0 0 5	2 1 6	4 5 9	—	19.1	35.1	38.3	7.4	—	0.1	—	—	517	3 11 6
4	Mixed	1,079	0 13 8	5 3 11	1 2 4	1 14 8	0 17 4	0 4 10	0 7 10	0 19 4	2 4 10	—	—	0 1 8	13 10 5	0 12 0	0 4 8	12 13 9	20 12 0	—	69.5	23.5	1.0	—	—	—	—	6.0	511	4 1 9
5	Ranching	2,533	—	—	0 3 4	0 9 9	0 18 8	0 0 5	0 0 2	0 0 7	0 8 6	—	0 0 11	1 11 6	3 13 10	—	0 1 1	3 12 9	4 13 3	—	—	—	14.1	72.5	—	11.5	—	1.9	418	2 5 6
7	Mixed	1,773	—	0 0 2	0 5 0	0 4 3	0 2 1	0 1 6	0 0 3	0 1 11	0 14 4	0 0 4	0 2 5	−0 3 6	1 8 9	—	—	1 8 9	1 15 2	8.8	49.1	7.8	22.1	9.3	2.9	—	—	—	494	4 3 11
9	Ranching	986	0 1 4	—	0 15 6	0 15 1	0 16 5	0 0 8	0 0 9	0 6 11	0 15 9	0 2 0	0 4 4	1 3 11	5 2 8	—	0 0 5	5 2 3	2 13 6	—	—	0.6	91.8	6.3	1.3	—	—	—	339	3 8 10
10	Breeding	486	—	—	1 9 4	0 5 1	0 7 2	0 1 1	0 0 1	0 5 2	0 10 8	—	0 4 7	0 12 8	3 15 10	—	0 0 8	3 15 2	0 19 2	—	1.2	4.9	87.8	4.9	1.2	—	—	—	443	2 2 2
13	Grazier	242	0 17 11	1 6 10	0 11 4	0 10 5	0 11 2	0 1 4	0 1 4	0 6 5	0 17 4	0 6 0	0 6 3	0 4 0	6 0 4	0 12 3	—	5 8 1	2 4 5	—	10.1	23.5	58.0	8.4	—	—	—	—	496	4 8 4
16	Ranching	6,976	—	—	0 7 8	0 9 10	0 4 0	0 0 11	—	0 0 7	1 7 1	0 2 6	0 0 6	0 0 8	2 13 9	—	0 0 7	2 13 2	7 14 3	—	10.6	52.8	32.9	3.7	—	—	—	—	462	4 1 7
17	Breeding	1,979	0 6 7	0 5 8	0 10 7	0 4 7	0 10 3	0 0 5	—	0 10 2	0 9 10	—	0 4 5	0 16 7	3 19 1	—	0 0 5	3 18 8	—	—	—	—	—	—	—	—	—	—	—	—
19	Breeding	404	0 0 11	0 7 9	0 7 6	1 6 3	0 11 0	0 1 3	0 0 3	0 8 7	0 14 7	0 0 1	—	2 8 8	6 6 10	—	0 5 10	6 1 0	8 7 7	—	6.7	20.0	41.7	18.3	13.3	—	—	—	486	3 10 4
29	Ranching	2,721	0 4 9	—	0 3 8	0 16 5	0 5 9	0 0 8	—	0 1 7	0 13 2	0 3 8	0 4 6	−0 3 3	2 10 11	—	0 0 11	2 10 0	3 11 4	—	8.7	23.0	45.8	18.4	—	4.1	—	—	438	4 0 2
30	Ranching	1,221	—	—	0 12 0	0 13 6	1 1 1	—	—	0 16 8	1 2 7	—	0 5 9	−0 8 5	4 3 2	—	—	4 3 2	6 1 3	—	—	16.6	54.6	25.4	—	3.4	—	—	407	3 12 1
31	Breeding	605	0 0 4	0 11 7	0 6 9	0 4 4	0 11 1	0 1 0	0 0 1	0 3 8	0 11 1	—	0 0 4	0 3 8	2 13 11	—	0 1 0	2 12 11	—	—	—	—	—	—	—	—	—	—	—	—
34	Breeding	395	0 2 1	0 8 3	0 19 8	0 12 2	0 7 7	0 1 6	0 0 7	0 10 8	0 18 11	0 9 4	0 11 5	2 15 1	7 17 3	—	0 4 1	7 13 2	—	—	—	—	—	—	—	—	—	—	—	—
36	Mixed	282	0 17 5	2 8 1	0 16 4	1 4 11	2 2 9	0 11 10	0 4 5	0 11 4	1 10 7	—	—	−2 0 8	8 7 0	0 4 8	0 2 6	7 19 10	—	—	—	—	—	—	—	—	—	—	—	—
37	Mixed	222	0 6 4	17 0 11	2 12 4	1 16 9	1 0 1	0 1 0	0 6 8	1 5 6	1 8 5	0 16 2	—	−7 18 5	18 15 9	2 4 8	—	16 11 1	—	—	—	—	—	—	—	—	—	—	—	—
38	Mixed	402	1 9 7	1 0 9	1 9 11	0 3 9	0 2 9	0 0 11	0 0 3	0 10 5	0 11 3	—	—	2 4 0	7 13 7	0 4 8	0 2 1	7 6 10	5 1 2	7.5	37.5	4.2	50.8	—	—	—	—	—	487	4 11 2
40	Mixed	287	0 8 8	0 13 5	1 2 2	0 19 11	2 13 4	0 13 3	0 0 6	0 13 3	2 4 11	0 0 5	—	0 5 3	9 15 1	0 1 4	—	9 13 9	—	—	—	—	—	—	—	—	—	—	—	—
42	Feeding	203	0 14 6	3 19 10	0 8 10	0 3 3	0 9 10	0 1 9	0 0 7	0 10 9	0 17 10	0 3 11	0 1 2	0 6 8	7 18 11	0 17 4	—	7 1 7	1 3 7	—	40.5	34.5	25.0	—	—	—	—	—	493	n.a.
43	Breeding	107	0 1 7	1 9 9	0 16 11	2 4 7	2 1 11	0 2 4	—	0 8 8	1 9 0	0 1 1	—	−2 7 6	6 8 4	—	—	6 8 4	—	—	—	—	—	—	—	—	—	—	—	—
44	Mixed	393	2 4 10	2 5 5	2 2 6	1 15 9	2 0 9	0 2 8	0 0 7	1 1 8	0 17 6	0 11 7	—	2 16 3	15 19 6	0 10 10	0 0 6	15 8 2	—	—	—	—	—	—	—	—	—	—	—	—
48	Breeding	525	0 2 7	0 12 8	0 14 4	0 5 7	1 9 3	0 1 1	0 0 4	0 2 5	0 16 0	0 0 3	0 9 4	−2 17 11	1 15 11	0 4 5	0 2 3	1 9 3	3 12 1	—	22.9	34.3	17.1	25.7	—	—	—	—	495	4 3 6
51	Ranching	631	—	0 0 9	0 8 4	0 8 9	0 7 4	0 0 9	0 0 3	0 1 7	0 6 9	—	0 1 7	−0 12 11	1 3 2	—	0 0 4	1 2 10	0 16 5	—	5.0	72.1	19.9	3.0	—	—	—	—	436	3 9 5
52	Ranching	580	—	—	0 7 4	0 9 1	0 11 6	0 0 10	0 0 1	0 5 6	1 3 0	0 1 1	—	1 2 0	4 0 5	—	—	4 0 5	11 2 4	—	—	—	100.0	—	—	—	—	—	395	2 17 9
53	Ranching	912	—	—	0 5 2	1 3 5	0 17 10	0 0 3	0 0 5	0 3 6	0 19 11	0 0 6	0 8 2	−1 6 10	2 12 4	—	0 2 4	2 10 0	4 11 0	—	14.9	52.6	28.3	1.4	1.4	1.4	—	—	573	3 13 10
54	Ranching	872	0 1 7	0 5 6	0 11 8	0 16 8	0 18 7	0 0 6	—	0 1 10	0 10 6	0 7 7	0 2 6	−2 11 6	1 5 5	—	—	1 5 5	1 6 0	—	3.4	51.7	44.2	0.7	—	—	—	—	575	4 0 2
55	Ranching	1,308	0 1 10	—	0 5 6	0 12 11	0 12 5	x	x	0 3 5	0 19 4	—	0 3 11	2 10 5	5 9 9	†0 0 8	0 0 9	5 8 4	5 0 4	—	13.9	53.5	26.2	1.8	0.2	—	2.2	2.2	517	4 0 11
56	Ranching	435	0 1 0	0 0 8	0 7 8	1 9 4	3 6 10	0 0 9	0 0 10	0 7 8	0 14 9	0 2 11	—	−0 18 11	5 13 6	—	0 1 3	5 12 3	5 0 7	—	12.2	55.1	—	32.7	—	—	—	—	441	3 19 10
58	Feeding	705	10 9 6	5 10 3	0 7 2	0 7 5	0 5 6	x	x	2 5 11	1 2 7	x	x	14 1 10	34 10 2	4 2 2	0 3 6	30 4 6	6 1 9	0.2	48.5	32.6	18.1	0.6	—	—	—	—	577	4 19 4
60	Mixed	677	0 2 1	1 7 9	0 8 10	0 16 10	0 8 6	0 1 10	0 0 8	0 5 8	0 15 9	—	—	0 4 4	4 12 3	0 2 8	0 1 4	4 8 3	—	—	—	—	—	—	—	—	—	—	—	—
63	Mixed	47	0 2 6	1 17 8	3 17 10	0 19 10	1 16 0	0 3 1	0 0 4	0 13 8	0 13 10	0 2 2	—	−0 5 9	10 1 2	0 0 5	—	10 0 9	—	—	—	—	—	—	—	—	—	—	—	—
66	Breeding	506	0 1 11	0 4 0	2 8 6	0 0 10	0 18 4	0 1 0	—	0 4 8	0 17 1	—	0 0 3	−1 7 6	3 9 1	0 0 3	0 0 6	3 8 6	2 4 0	—	17.4	55.7	26.2	—	—	—	—	0.7	462	3 14 5
67	Breeding	187	0 0 11	1 13 6	0 17 5	0 12 1	0 11 11	0 0 7	0 0 3	0 5 0	0 9 7	0 0 5	—	−0 17 6	3 14 2	0 1 4	0 0 7	3 12 3	—	—	—	—	—	—	—	—	—	—	—	—
Total		44,951	19 14 5	48 15 1	28 11 11	25 6 9	30 5 2	3 0 8	1 7 6	14 15 9	31 1 8	3 14 11	3 12 8	8 17 8	219 4 2	9 19 8	1 18 0	207 6 6	108 16 11										10,462	78 16 6
Average		1,352	0 11 11	1 9 8	0 17 4	0 15 4	0 18 4	0 1 10	0 0 10	0 9 0	0 18 10	0 2 3	0 2 2	0 5 5	6 12 11	0 6 1	0 1 2	6 5 8	*4 18 11										*476	3 15 1 :
%			9.0	22.2	13.0	11.6	13.9	1.4	0.6	6.8	14.1	1.7	1.6	4.1	100.0	4.5	0.9	94.6	—	*0.8	*17.8	*29.7	*37.7	*11.1	*1.4	*0.9	*0.1	*0.5		

* Average of 22 only. x Included in General Expenses. † Bull Subsidy. n.a.: Not available. : Average of 21 only.

Animal Husbandry Officer, Mr. J. Raath, and the Animal Husbandry Officer, Department of Conservation and Extension, Mr. A. Morrison, and statistical data was provided by the Central African Statistical Office.

The investigation is being continued, and it is hoped that more farmers will favour the Branch with their co-operation and interest.

APPENDIX II.

METHODS USED IN CATTLE COSTING, 1950-51.

Throughout the costings all direct costs have been taken at actual cost to the farmer wherever this has been possible. The purchased foods have been taken at cost, as have native labour, European employees' time, dip, veterinary expenses and cattle medicines, transport and sundry expenses. Home grown foods have been charged in at estimated cost (listed below); the farmer's own time at a rate of 44s. 6d. per day; haulage by the farmers own transport at 9d. a mile for vanettes and 1s. 6d. a mile for lorries, and tractors have been taken at £2 a day.

Charges for Home Grown Foods.

Ensilage	£2	10	0	per ton.
Sunflowers	£1	2	0	per bag of 125 lbs.
Maize	£1	3	0	per bag of 200 lbs.
Maize Stover	£0	5	0	per ton.
Veld Hay	£2	0	0	per ton.
Velvet Bean Hay	£4	0	0	per ton.
Sunnhemp Hay	£3	0	0	per ton.
Green Oats	£4	0	0	per ton.
Pumpkins	£2	5	0	per ton.

The item "Grazing" represents an allowance for the capital invested in land and improvements, such as fencing, dams, boreholes, etc., this allowance being a 5 per cent. interest charge, and any rentals paid for land leased.

"General Overheads" consist of those items such as insurances, telephone and postage, general labour on maintenance work, etc., which cannot, on a mixed farm, be directly allocated to any particular enterprise, and have been estimated where full accounts have not been available.

"General Beef" comprises general sundry expenses and an interest charge on the capital invested in cattle, buildings and machinery directly concerned with cattle production (again the charge has been taken at 5 per cent. of the capital).

"Herd Replacement" is based on the opening and closing valuations of cattle, and takes into account the cost of maintaining the breeding stock and any increase or decrease which has taken place in the herd during the year.

"Manurial Residues" have only been credited where the manure or compost has been applied to sale crops on a mixed farm. These residual charges are based on the protein (nitrogen) content of the feeding stuffs consumed by the cattle. They have been calculated in conjunction with the Chief Chemist, and are as follows:—

Decorticated Cotton Cake	£8	0	0	per ton.
Undecorticated Cotton Cake	3	0	0	,, ,,
Groundnut Cake.....	6	0	0	,, ,,
Bone Meal	5	0	0	,, ,,
Oats	0	19	6	,, ,,
Veld Hay	0	12	0	,, ,,
Straws	0	6	0	,, ,,
Maize and Maize Products	0	16	0	,, ,,
Sunflower Seed	0	12	0	,, ,,
Bean Hay	0	13	0	,, ,,
Ensilage (not grass)	0	9	0	,, ,,
Grass Ensilage	0	16	0	,, ,,
Sunnhemp Hay	0	3	0	,, ,,

"Hides" are hides sold from animals which died or were slaughtered for farm use, and do not include hides (or hide bonus) from livestock sold.

Australian Journey

Report on a Visit to Australia and New Zealand for the purpose of Studying Pasture Problems.

By OLIVER WEST, D.Sc.,

Senior Research Officer, Department of Research and Specialist Services.

PART I.

WESTERN AUSTRALIA.

Flocks of silver gulls and the smell of bush fires welcomed the "Athenic" outside Freemantle at 6 a.m. on April 14, 1950. Our arrival coincided with the end of a very dry, dry season. Extensive bush fires were raging, and in the early morning the land seen from the harbour was covered by a pall of smoke. We found that the local papers were featuring bush fire news to the temporary exclusion of almost everything except the racing.

Freemantle lies at the mouth of the Swan River. It is the port of Perth, which is the capital of Western Australia and, as Thomas Wood described it, "Australia's front door to Europe." Perth is a remarkable city in that it has grown around a hill called King's Park, in which some of the very rich flora of Western Australia is preserved in its natural state. From King's Park there are wonderful views of Perth Water, a broad lake-like reach of the Swan, dotted with sailing boats and surrounded by the city. I saw schools of porpoises in Perth Water, 12 miles from the open sea.

The University of Western Australia in Perth, an architectural gem in a beautiful setting of gardens and lawns, was the first and may be the only University in the British Empire that is entirely free. The University includes a **Faculty** and an **Institute of Agriculture.** This was my first port of call and where I spent much of my short stay in Western Australia.

Most of the staff of the Institute are members of the University Staff, but attached to it and stationed at the Institute are a number of the research personnel of the C.S.I.R.O.

At first much of the research carried out by the Institute was concerned with the problems of the huge semi-arid pastoral areas of the State of Western Australia. Latterly, however, more attention is being paid to the better watered areas. Problems are grouped in four categories:—

1. Ecology and conservation of the vegetation.
2. Nutrition and fertility of sheep.
3. Wool problems, notably "canary stain," "tenderness," and "break."
4. Vermin problems, particularly kangaroos.

Published work includes a pastoral map in which Western Australia is divided ecologically into 15 regions, numerous ecological studies of the "Spinifex" areas of the North West and the "Mulga" areas of the Central Murchison and the North Eastern Gold Fields, and studies of the nutritive value of Spinifex and Mulga.

One of the major disabilities of the pastoral industry in the Northern area is the low reproductive rate, and this has led to much work on the fertility of sheep. It has been found that there is a very close correlation between rainfall and the lambing percentage, and it is therefore apparent that the condition of the pasture is of dominant importance in determining the reproductive rate. (There is local evidence that this may explain in part the low calving percentages characteristic of Rhodesian ranch herds, and that the improvement in the grazing consequent on the adoption of better veld management practices may be expected to bring in its train a better calving rate.)

Very interesting studies have been carried out in the Ruminal Flora of Sheep, in the biological value of certain protein concentrates, namely, commercial meat meals and seed of the Western Australia Blue Lupin, on Vitamin A in the nutrition of sheep and the carotine content of pastures, fodders and grains, and in the chemical composition of wheat and its mill products.

Early researches into the "Denmark Wasting Disease" or enzootic marasmus of cattle by Filmer and Underwood established that it was the result of uncomplicated cobalt deficiency. This has led to a considerable amount of research in the cobalt content of pastures.

THE WORK OF THE OFFICERS OF THE DIVISION OF PLANT INDUSTRY OF THE C.S.I.R.O.

R. C. Rossiter, E. T. Bailey and Ron Pack, officers of the Division of Plant Industry, C.S.I.R.O., stationed at the Institute of Agriculture, did their best in the short time available to make my unexpected visit as profitable as possible. I was shown the grazing trials and the Plant Introduction Nursery at the University and was taken out to Gin Gin by Ron Pack and through the Darling Range to Quairading in the wheat belt and back by E. T. Bailey.

In grazing trials at the Institute, groups of two Merino wethers were being carried at a stocking rate of 2¾ sheep to one acre. Two systems were being compared: **continuous grazing** as against a system of **simple deferment** in which one quarter of the area was protected from grazing during the growing season (winter). There were no replications.

What struck me was the fact that the sheep were deriving a living from paddocks which were apparently bare, except for a light covering of leaves and stems on the surface of the sandy soil—on this sparse covering of dried vegetable fragments plus, and this seems to be the secret, the burrs buried in the sandy soil, they maintain their weight in a very satisfactory manner. I was to see much more extreme instances of this form of grazing later on the way to Quairading.

Other work included Wimmera Rye Grass investigations and studies of major and trace element deficiencies.

I was told that responses to potassium and zinc are being obtained with Dwalganup subterranean clover at a number of centres; the effect of potassium being especially marked on the deep sandy coastal soils and that in pot cultures, where an interaction effect of potassium and copper had been obtained on the growth of subterranean clover, in a soil from West Gin Gin, the response to **copper** occured only in the presence of **potassium**.

INFERTILITY ASSOCIATED WITH SUBTERRANEAN CLOVER.

In the early years of the war, a very serious threat to the sheep industry of the southern agricultural areas arose in the form of a breeding problem characterised by infertility, maternal dystocia and prolapse of the uterus. The trouble was found to be associated particularly with pastures dominated by Dwalganup Subterranean Clover, and it was so serious that many farmers were ruined or nearly ruined.

Co-operative investigations carried out by C.S.I.R.O., the University and the State Department of Agriculture, discovered that the trouble was due to an oestrogen-like substance contained in the clover—Bio-assay investigations have since shown that all strains of subterranean clover are potent, while most other legumes, grasses, etc., contain much smaller quantities of the harmful substance.

A very interesting point is that the trouble appears to have arisen when, because of the outbreak of war, superphosphate became unobtainable and top dressing of pastures had to be abandoned. It ceased to be important very soon after phosphate supplies were again available.

The C.S.I.R.O. staff assist in co-operative grazing trials concerned with this problem at Warrogin, Wandering and Kojonup. The shortness of my stay made it impossible to see anything of this work or of the development of the newly purchased Glen Lossie Field Station at Kojonup.

EXCURSIONS TO GIN GIN AND TO QUAIRADING.

Gin Gin is a small village in pleasant rolling country north of Perth, where Western Australia Blue Lupins are an important self-regenerating summer (dry season) grazing crop. We travelled through the pleasant vineyards of the Swan Valley and along the Ellen Brook to Muchia. The Muchia sand—a siliceous sand of very low inherent fertility—is one of the problems on which the C.S.I.R.O. staff is working.

The way to Quairading led us west, through Armadale at the foot of the Darling Range, past the Canning Dam and through the range to Beverly and Quairading. We returned through York and Mundaring.

The Darling Range is hilly, well wooded country, with Jarrah and Red Gum very prominent. Conspicuous in the undergrowth was a Macrozamia sp., with Bracken, and in open glades the "Black Boy" and numerous myrtaceous and Proteacous shrubs. We saw Dryandra, Banksia, Calothamnus, Hakea and many other genera quite new to me.

We traversed several areas through which bush fires had recently swept, and I was amazed to see how little damage to the Eucalypts had been caused by what were obviously very fierce fires. It became evident that in Australia, as in Africa, fire through the ages must have played a very important part in the moulding of the vegetation and in the production of fire resistant sub-climaxes. In badly drained areas on the Western side of the range, White Gums were prominent, producing a picturesque woodland of gnarled and twisted trees.

Through the range the landscape opened into the gently rolling country of the Avon Valley. Relic patches of Jam (*Acacia acuminata*) and York Gum (*Eucalyptus foecunda* var. *loxophleba*) indicated the presence of the "red-brown earth" soil zone, and the endless bush gave way to wide cleared areas of cultivation.

Wheat is grown here in a simple wheat fallow rotation in which sheep are used as cultivating implements to keep the fallow bare. Subterranean Clover—Wimmera Rye Grass leys are now playing an increasingly important role in this region, and a large acreage of winter cereals is grown for grazing. The bareness of these annual leys at the end of the dry season was very striking. At this time of the year the sheep derive most of their sustenance from the buried burrs which they dig out of the soil.

Around Beverly and on to Quairading, practically all of the country is cultivated except the very infertile patches of sand plain underlain by laterite and carrying a macchia-like shrubby vegetation. We saw very little contour farming and where the slopes were steep, incipient gully erosion was prominent, as it was along the course of the salt springs which are a feature of this country.

Many fields were being prepared for sowing and some, in anticipation of the advent of the rains, were being sown dry. I was interested to see that little or no ploughing is practised. The universal implement appeared to be the **combine,** a grain drill in which the discs are replaced by a set of tines and by which a very satisfactory scarifying of the light soils can be carried out. Where the fallow is in good condition, only one operation is necessary, but where it is necessary to prepare the seed-bed more carefully, the empty combine is taken over the land first. Because a tined implement is unsuitable for working in stubble, cereal stubbles are burned by fire harrowing before they are combined.

On the highway we were continually passed by very heavy grain trucks—semi-articulated American vehicles—carrying, I was told, about 10 tons of wheat, loose not bagged, travelling at very high speeds, conveying the last of the previous season's crop from the roadside silos to the wheat elevators in Freemantle.

The trip to Quairading ended my stay in Western Australia. I sailed on the following day for Adelaide.

I was sorry that the shortness of my stay prevented me from seeing more of the work of C.S.I.R.O. in that State, and I regretted I had not made contact with the State Department of Agriculture; that I had been forced to turn down an invitation from the manager of the Bank of New South Wales to tour with their Agricultural

Adviser; and worse still, that I had been unable to visit any of the summer rainfall country in the North West and Kimberley Divisions, where conditions are much closer to semi-arid Eastern Africa and where at Katherine and on the Ord River, C.S.I.R.O. and the Western Australia Department of Agriculture are carrying out investigations that would be of great interest to Rhodesia. It was a pity, too, that by arriving too early, I had missed seeing the wild flowers for which Western Australia is famed, but I was glad that I had been able to see a little of a very hospitable and interesting country.

We sailed south, close into the coast, and got good views of the Cape Naturaliste Lighthouse behind which lies Geographe Bay, and next morning of the wild and spectacular coast near Albany.

SOUTH AUSTRALIA.

I landed at Adelaide on Monday, April 24, and left by air for Melbourne on Thursday, April 27. In the short time I spent in South Australia, I saw something of Adelaide, visited the Headquarters of the **Division of Bio Chemistry and General Nutrition** of the C.S.I.R.O. at the University, spent an afternoon and a morning at the Waite Agricultural Research Institute, and was taken on a two-day trip to Keith in the "90 mile desert."

That I was able to see all I did was due to Mr. David Riceman, Senior Research Officer (Plant Nutrition) in the Division of Bio Chemistry and General Nutrition, who made contact with me as soon as I landed and saw that all of my time was fully occupied until I left.

THE DIVISION OF BIO CHEMISTRY AND GENERAL NUTRITION.

At the Division of Bio Chemistry and General Nutrition of C.S.I.R.O., I had the privilege of meeting Mr. H. R. Marston, F.R.S., renowned throughout Australia and the scientific world for his organisation of the Division of which he is Chief and for the spectacular work of the Division on cobalt and copper deficiencies which has made a future for what was formerly useless country. The story, in his own words, is as follows:—

> "A great part of the soils along the seaboard of Southern Australia are of Aeolian origin—their genesis probably dates from a period of extreme aridity in post Pliocene times.
>
> "The coastal fringes are composed essentially of marine shell fragments, windborne into gently rolling dunes that cover unconformably and at considerable depth the underlying strata. These merge imperceptibly through unconsolidated limestone ridges, intersected by brown soils—residua derived apparently from leaching of the older dunes—into a hinterland, where light siliceous sands imposed upon solonised subsoils prevail over relatively large areas.
>
> INDIGENOUS PLANT ASSOCIATIONS ON THESE SOILS.
>
> **"Most of this terrain is in a zone of secure and adequate rainfall.** The calcareous littoral supports a very simple plant association in which two calciphile grasses, *Bromus madri-*

tensis and *Lagurus ovatus*, overwhelmingly predominate. The siliceous sands constitute the so-called Mallee Deserts (90 mile desert), where a low and stunted heath of dwarfed Eucalypts, Banksia spp., Xanthorrhea sp., etc., etc., has become inured to the penury of the deficient environment. **Desultory attempts to farm these tracts failed, and all but the marginal areas were abandoned for agriculture.**

COAST DISEASE AND RELATED MALADIES.

"The earliest settlers who ventured to graze their flocks on the natural pastures of the littoral found their enterprise hazardous. Sheep confined to these tracts invariably became anaemic and would waste and die, usually within a year. This was the problem that attracted us—it provided the clue which led to the solution of these refractory lands." (H. R. Marston, "Work of the Division of Bio Chemistry and General Nutrition of C.S.I.R.O." Proc. Roy. Soc. A. Vol. 199, 1949, pp. 273-294.)

Deficiencies in the grazing of **Cobalt** and **Copper** proved to be responsible for the malady which made it impossible to run sheep or cattle. The response to **Cobalt** was dramatic, and—

"the inference that those maladies (in other parts of the world) which are characterised by a similar syndrome might also originate from cobalt deficiency proved correct. A year or so after our first announcement, the New Zealand **bush sickness,** which affects sheep on soils derived from acidic volcanic ejecuminata, the Western Australian **enzootic marasmus,** which affects sheep on certain red loams, the **Vinkish** and **daising** of the Cheviots, the **pine** of the raised beaches of the inner Hebrides, the **salt sickness** of the coral sands of Florida and similar maladies elsewhere were all demonstrated by others to respond dramatically to cobalt."

The animal problem solved, the reasons for the failure of crops and pastures were investigated. For the Aeolian soils of the littoral a dressing of 7 lbs. CuSo4 5H20 / acre applied at sowing time prevented the flagrant lesions and failure to head which had been observed in oats and other cereal crops. Nitrogen then became the limiting factor, and when nitrogenous manures were superimposed the yield was more than doubled.

On the siliceous sands of the hinterland (The Sand) it was proved that although there was a severe copper deficiency, **Zinc** and not **Copper** was the first limiting factor:—

"When the phosphate level of these virgin soils was raised, oats grew and yielded a poor crop of less than 10 bushels / acre. Dressings of copper produced no significant response. A dressing of 7 lbs. $ZnSO_4.6H_2O$ / acre prevented the accumulation of anthocyanin and doubled the yield before the low nitrogen status of these soils became the limiting factor. Lucerne responded to **Copper,** but not to **Zinc**—here again a species difference. Subterranean Clover failed completely to develop without additional **Zinc,** grew luxuriantly with it, but in the absence of a dressing of copper failed to set visible

On the road to Quairading, Western Australia. A close-up illustrating the bareness of Subterranean Clover Pasture at the end of the dry season.

Dry Land Lucerne near Keith in "90 Mile Desert," South Australia.

The Riverina. Murray Valley, near Echuca. Flight to Deniliquin, New South Wales.

Callitris glauca near Deniliquin, New South Wales.

Salt Bush (*Atriplex versicaria*) country near Hay, New South Wales.

Phalaris tuberosa at Collector, near Canberra.

Subterranean Clover pasture on Gundaringa, near Crookwell, New South Wales.

Pasture Development on Bald Blair, New England Tableland.

A Billabong surrounded by Colabar trees, west of Moree, New South Wales.

Natural Grassland west of Collarenebri, New South Wales.

Merinos grazing *Chloris ventricosa* grassland between Cato and Engonia, New South Wales.

Mulga near Byrock, New South Wales.

seed and so did not persist. Further series of experiments proved unequivocally that splendid, high-yielding permanent pastures could be established by growing the perennial grass, *Phalaris tuberosa*, and the annual, Subterranean Clover, with a dressing of superphosphate enriched with 7 lbs. each of $ZnSO_4.6H_2O$ and $CuSO_4.5H_2O$ / acre . . . . . about 3,000 square miles of sand heath is involved."

The Division is splendidly housed in a large modern building in the University grounds.

JOURNEY TO KEITH.

The road leads first over the Mount Lofty Range, which dominates Adelaide and makes a very pleasant view that can be seen from almost anywhere in the city streets—this favour is reciprocal, because from Mount Lofty we were afforded a very fine view of the city lights.

Across the range and down into the Mallee, my first view of this very interesting community in the head-lights of our car; we crossed the Murray at Murray Bridge and followed it to Tailem Bend and then along the road to Border Town, through Coomandook, Yumali, Ki Ki, Coonalpyn, Culburra, Tintinara, Kumorna, Coombe, Bancalla to Keith.

After breakfast next morning we drove out to a farm owned by Mr. Jack Summers, in typical Mallee and heath country. Ten years previously this country could have been purchased at about 4s. 6d. per acre—now it is worth 30s. as it stands, while developed land costs upwards of £10.

The vegetation is interesting, consisting of patches of Mallee, small stunted Eucalypts, with occasional Callitris and patches of open heath, a macchia-like vegetation composed mainly of small shrubby plants of Banksia spp., Xanthorrhea sp., Hakea spp., Myrtaceae, etc., etc. It is good bee-keeping country. Summers carries on his farm about 1,200 merino wethers on 1,000 acres of cleared land on which he has established Subterranean Clover and Wimmera Rye.

This annual pasture is dressed each year with 200 lbs. Supers per acre, plus Zinc and Copper. He told me that he estimated the cost of developing virgin heath to Wimmera—sub. clover—pasture to be about £10 per acre.

I was interested to see that his sheep were dipped in a circular spray house. The spraying system is very labour saving and is coming into general use for sheep throughout Australia. Shearing on these Mallee farms is done co-operatively at community shearing sheds.

On our way back to Keith we inspected some very fine stands of dry land lucerne.

On our homeward journey we crossed the Murray by pont at Tailem Bend to visit the irrigated dairy pastures across the river between Tailem Bend and Murray Bridge. They were very fine pastures, a mixture in which we were able to identify *Phalaris*

tuberosa, Perennial Rye and White Clover, all sub-divided into small paddocks of about five acres each. The cows grazing them were mostly Friesland grades, with some nondescript Jerseys. The system of irrigation used is interesting—most of the developed pastures are lower than the river; the water is gravitated in, drained into ditches, and then pumped back to the river.

Between Murray Bridge and Adelaide I noticed on our way back, that *Themeda australis* was an important grass in protected areas such as road sides and along the railway.

THE WAITE AGRICULTURAL RESEARCH INSTITUTE.

The Waite Agricultural Research Institute was founded in 1924 as the result of a gift by Mr. Peter Waite to the University of Adelaide. The original endowment comprised an estate of 300 acres, a mansion house and a trust fund of approximately £58,000. I had tea with Professor Prescott, the Director of the Waite, in this house—a mellow brick building and surely one of the finest houses in Australia—on the afternoon of Anzac Day. Anzac Day is a holiday and a day of remembrance. All the morning the streets of Adelaide and every other city in Australia had resounded to the tramp of the marching feet of thousands of men parading in memory of those who fell in the two world wars.

In the afternoon, at the Waite on the edge of the city and at the foot of the scarp of Mount Lofty, I was transported to a world at peace—buildings mellow in the warm yellow sunshine, galahs wheeling and the sound of bees. After tea we walked through the grounds and visited the stables, workshops, the laboratories, and the lecture halls, while Professor Prescott told me about the Waite and the work they were doing there.

I spent a morning at the Waite on the day I left Adelaide for Melbourne—a working day this time, and as I was hurried from one laboratory to another, from a group working on soils to an ecologist interested in saltbush at Yudnapinna, I realised again the futility of trying to see a lot in a very short time.

This is what I learned at the Waite of the work that is being done there:—

The work at the Waite Research Institute is shared by the University of Adelaide and by the C.S.I.R.O., for which it is the headquarters for the whole of Australia of the Division of Soils.

The School of Agriculture (Faculty of Agriculture) of the University of Adelaide is centred at the Waite. Under the terms of the Agricultural Education Act, this School of Agriculture undertakes investigations in Agriculture and allied subjects and provides for advisory services in Entomology, Plant Pathology and Systematic Botany through the Minister of Agriculture to the Departments of Agriculture and Woods and Forests. The University thus provides in South Australia a service which elsewhere in Australia is a function of the States Departments of Agriculture.

While the Institute provides courses of instruction for students proceeding to degrees in Agricultural Science and the advisory services already referred to, its main objective is the prosecution

of research on plant and soil problems, and while each group is organised separately, the work of the University staff and of the C.S.I.R.O. staff is dovetailed as far as is possible.

In the University there are Departments of Agricultural Chemistry, Agronomy, Entomology, Plant Pathology and Plant Physiology. In C.S.I.R.O. the Division of Soils has groups at work on Soil Surveys and Pedology, Soil Chemistry, Soil Physics and Soil Microbiology. Others are concerned with Oenological Research.

The Department of Agronomy covers General Agronomy, Grassland, Ecology, Genetics, Plant Breeding and Systematic Botany. The South Australian environment has been examined in terms of climate and soil factors and related land use and management. Pastures have received continuous attention from the inception of the Institute, and the resulting stimulus has led to many of the grassland researches now in progress throughout Australia.

The Institute maintains a field station at Yudnapinna, some 50 miles North West of Port Augusta. This is in Salt Bush—Blue Bush country with an annual rainfall of 7-8 inches.

NEW SOUTH WALES AND VICTORIA.

By Air to Deniliquin, New South Wales.

I left Adelaide for Melbourne by Convair Air Liner of the T.A.A. at about 4 p.m. on April 27, 1950, arriving at Melbourne two hours later, a distance of about 405 miles. On taking off, the view of St. Vincent's Gulf was rather spoiled by the glare of the sun. We crossed the Murray somewhere between Murray Bridge and Tailem Bend, and got a very good view of Lake Alexandrina where the Murray enters the sea. The ancient dunes of the coastal fringe of the 90 mile desert were very plain from the air, and later the rich wheat lands of the Wimmera in Victoria made a splendid picture in the soft evening light. We passed over Dimboola and located Murtoa by the huge wheat storage sheds. Leaving the Grampions, Victorian Mountain beauty spot, and Ballarat of gold rush fame, we crossed the southern end of the Great Dividing Range and landed in Melbourne, a city of over a million inhabitants and the second largest city in the Commonwealth.

C.S.I.R.O. had seen me off in Adelaide; in Melbourne I was met by their Publicity Officer, Mr. Durem. Not long after daybreak on April 28, 1950, I was in the air again bound for Deniliquin in the New South Wales Riverina, flying A.N.A. this time in a Dakota. We passed over the rich dairying and mixed farming country centred on Seymour, and then flew on over country much of which was flooded, along the valley of the Goulburn River to the River Murray, which we crossed near Echuca. At Deniliquin, Mr. Ron. W. Prunster, Officer in Charge of the Regional Pastoral Laboratory and Falkiner Memorial Field Station, C.S.I.R.O., was on the landing ground to meet me.

DENILIQUIN, THE REGIONAL LABORATORY.

The Regional Laboratory and Field Station at Deniliquin is a purely C.S.I.R.O. undertaking, but one in which several Divisions of that organisation play a role. Concerned in the investigations are the C.S.I.R.O. Divisions of Soils, Plant Industry, Animal Health and Production, and Bio Chemistry and General Nutrition. The Officer in Charge is a member of the staff of the Division of Plant Industry.

Deniliquin was selected as the site for this regional station because geographically it is almost at the centre of the existing and planned irrigation areas of the Murrumbidgee and Central Murray Valleys, and because it lies at the Juncture of the two most important soil zones of this region, "the grey and brown soils of heavy texture," which lie to the north and west, and the "lighter red-brown earths" from the north east to the south west.

Furthermore, Deniliquin is the centre of a large and important sheep region where some of the most famous merino studs are carried.

The work of the station is divided into two phases; the first a study of the plants and animals in the natural dryland environment, the second, and more urgent, to resolve the wide range of agricultural problems associated with the use of irrigation water on partially irrigated holdings; the object of the investigation being to assist the sheep and wool industry of the Riverina by finding how best to use irrigation water coupled with fodder conservation to stabilise the region against serious losses in stock and wool in times of prolonged drought.

The station has only recently been established, at the time of my visit the laboratory was in process of erection, and hence most of the current investigations are exploratory and are of a short-term nature. It is the intention, as the development work progresses and additional research staff become available, to undertake more basic and longer-term investigations.

Most progress has been made in the **soils** investigations, which date back to 1929 and have resulted in a series of surveys in the irrigation areas of Victoria and New South Wales (the Murray River is the boundary). Maps already prepared cover 1,141,000 acres in detailed survey and 803,000 acres in reconnaissance.

Pasture investigations include a detailed survey of the native pastures of the Falkiner Station. As a result of this survey, a carrying capacity experiment with sheep on typical Danthonia pasture has been laid down. **On irrigated areas** a wide variety of grasses and legumes are being put through preliminary trials to find the most promising species and varieties for the area and various techniques of establishment and management are being investigated. Much of the irrigated soil is very intractable, and it is difficult to get water into it, hence methods for improving the structure of the surface soil are receiving a lot of attention.

Irrigation investigations comprise a comparison of contour and border check systems. Work on the water requirements of various crops and the changes induced in the soils by irrigation are being planned.

Animal investigations at present are confined to:—

(1) Assistance in the co-operative investigation of toxaemic jaundice of sheep—which is a form of copper poisoning caused by the grazing in seasons which favour an excessive growth of herbage other than grass.

(2) An investigation of *Heliotropium europaeum* poisoning. *H. europaeum* causes a disease of the liver and death in sheep. It is also connected with the ocurrence of *Toxaemic jaundice.*

THE VEGETATION AROUND DENILIQUIN.

To me one of the most interesting things about Deniliquin was that it receives a fair amount of summer rain (the annual average is 16.72 inches, of which 44 per cent. falls in the summer from October to March). All of the country I had seen previously was in the region where practically all of the rain falls in the winter and where, as in the Western Cape, the only Southern African equivalent, grassland as such is non-existent, but at Deniliquin I saw for the first time since my arrival in Australia a real grassland composed of perennial grasses, and the sight was so surprising that I had to stop on the way from the aerodrome to the town to examine it The important species are *Danthonia semiannularis* (Wallaby Grass), *Stipa variabilis* (Spear Grass), *Chloris truncata* and *Chloris acicularis* growing with a creeping salt bush, *Atriplex semibaccatum* and Cotton bush, *Kochia aphylla.*

Much of the area is treeless, but on the lighter textured soils *Callitris glauca* and *Hakea leucoptera* occur with Spear Grass, while the heavy swamp soils carry Black Box, *Eucalyptus largiflorens* and Cane Grass, *Egragrostis australasica.* Along the rivers, in areas occasionally flooded, are fine stands of large and lovely Red Gums.

The basal cover of the open grassland is 2.6 per cent. and the carrying capacity about three acres to one sheep.

VISIT TO CAROONBOON.

I was taken to visit a sheep station "Caroonboon," north of Deniliquin, on the way to Hay. On the way we saw stands of *Acacia pendula*, known as Boree, and Dillon Bush, *Nitraria schoberi.*

Caroonboon was in salt bush country with *Atriplex versicaria* occurring in almost pure stands over an immense area—with it were occasional specimens of Old Man Salt Bush.

The owner of Caroonboon, Mr. Theo Macaw, told me that his annual rainfall was 14 inches and that he could stock the salt bush on his station at one sheep to four acres. His wool clip averaged 11 lbs. per sheep and sold at 8s. per pound, each acre bringing in 22s. per annum. On hearing that I had only seen one kangaroo, and that at night returning from Gin Gin to Perth in Western Australia, he took me out across his paddocks and showed me hundreds. They were like Springbok on a well stocked Karroo farm, dotted over the plains in small groups in every direction.

THE ECHUCA TECHNICAL COLLEGE.

During my stay at Deniliquin, I delivered an address as one of the guest speakers to the Echua Old Collegians Agricultural Society at their annual dinner in Echua. It was a very pleasant function.

JOURNEY FROM DENILIQUIN TO ALBURY.

After lunch on Tuesday, May 2, Ron Prunster and I left Deniliquin by car for Rutherglen, the first stage in my journey to Albury, and on to Canberra, the Federal Capital. We drove through the lovely Murray Valley country, through Wollamai, Finley, Tocumwal, Mulwala, all on the New South Wales side of the river. At Mulwala we crossed to Yarrawonga on the Victorian side and continued through fine mixed farming country in which orchards were conspicuous, to Rutherglen, where we spent the night.

RUTHERGLEN RESEARCH STATION.

Next morning we visited the Rutherglen Research Station of the Victoria State Department of Agriculture. Rutherglen is the centre of a large important agricultural district where vineyards, cereal crops, wool, fat lambs and dairying are all important.

The Rutherglen Station is designed to cover as far as possible every phase of the district's agriculture—a considerable part of its activities are concerned with the culture of grapes and the making of wine. On the agricultural side, it has been responsible for the introduction into the district of the Wimmera Rye Grass—Subterranean Clover annual pasture, which associated with the use of superphosphate has revolutionised agriculture throughout the area.

Much work is being done on the effect of applications of fertiliser on crops and pasture, but at present the main effort is towards the introduction of alternate husbandry whereby Wimmera Rye Grass—Suberranean Clover leys will alternate with the production of cereal crops. Work is being carried out in the breeding and raising of fat lambs and on the feeding and management of pigs.

The dairy herd is peculiar in that it is the product of a system of criss cross breeding, in which Friesland bulls are alternated with Jersey bulls every two or three years.

After lunch in Rutherglen we continued on the Victorian side of the valley through Spring hurst, Wodonga, Huon and Tallangatta to the Hume Dam. The Hume reservoir, one of the many on the Murray system, is the largest reservoir in Australia, with a capacity of 1,250,000 acre feet.

We crossed the Murray on the road over the Dam Wall and travelled back to Albury, where we spent the night. Next morning I said good-bye to Mr. Ron Prunster, who had done so much for me in the time I spent with him and boarded one of the Murray Valley coaches on the last stage of my journey to Canberra. Our

route took us through Holbrook, Gundagai and Yass, lovely country, well grassed in places and often heavily timbered; everywhere were large areas of gaunt, dead, ringbarked trees, such a feature of Australian scenery.

In contrast to the extreme flatness of the country around Deniliquin and Hay, it was rolling and hilly. There was plenty of evidence of good farming, and I began to see small numbers of good type beef cattle (mostly Aberdeens). Yass, curiously enough, is situated in a treeless plain. We arrived at Canberra, where I was welcomed at the bus terminus by Dr. J. G. Davies and Mr. Collin Donald.

DIVISIONAL PLANT INDUSTRY, CANBERRA.

Dr Davies is Assistant Chief and Senior Principal Research Officer in the Division of Plant Industry, C.S.R.I.O., in charge of all pasture investigation. Mr. Donald, a Principal Research Officer, has as his special province all pasture investigations in the winter rainfall areas.

Next morning I was taken to the headquarters of the Division of Plant Industry, where I met Dr. B. T. Dickson, the Chief of the Division, W. Hartley, Senior Research Officer in charge of Plant Introduction, C. S. Christian, Principal Research Officer in charge of the Northern Australia Regional Survey, G. A. McIntyre, Senior Research Officer in the section of Mathematical Statistics attached to the Division of Plant Industry, A. J. Anderson, Research Officer, Mineral Deficiency Studies, and many others.

I spent five days in Canberra, most of which time was fully occupied in discussions with members of the Division of Plant Industry about their work in Australia and ours in Rhodesia. The Director of the North Australia Regional Survey was able by means of cine-films and coloured 35 mm. slides to give me a very good picture of the vast undeveloped areas, the potentialities of which his section are exploring.

The Biometrician, Mr. G. A. McIntyre, made a study of the rather complicated stocking rate experiments planned for Matopos, and his suggestions have resulted in a considerable improvement on the provisional design.

TRIP TO CROOKWELL.

Dr. Davies and Mr. A. J. Anderson took me out to see field experiments on the Molybdenum deficient soils around Crookwell. We travelled by the Federal Highway past Lake George and through Collector and Goulburn. Near Collector we inspected very fine stands of *Phalaris tuberosa* and Subterranean Clover, the first perennial grass, established pastures I had seen in Australia.

The vegetation in the country we traversed followed a characteristic pattern. The hill tops were covered with thicket (Eucalyptus), the slopes by a parkland of larger trees growing fairly closely in grassland, and the valley bottoms (heavy soils) were open grassland (Rhodesian vlei). In Africa this could be explained in terms of the incidence of fire.

Around Crookwell the unimproved natural pastures on the hill crests and slopes are dominated by *Danthonia pallida* and

Poa caespitosa (Tussock Grassland). The application of molybdenum has made it possible to grow good subterranean clover pastures on this poor country where previously this was impossible. This was illustrated in no uncertain manner in the factorial experiments we visited.

It has been found that **molybdenum** is deficient on all except the basaltic soils throughout the Southern Tablelands of New South Wales. **Sulphur,** too, is often deficient on the soils of sedimentary granitic and basaltic origin in this area. Both **Molybdenum** and **Sulphur** have been found to be of particular importance for symbiotic nitrogen fixation. **Sulphur** appears to increase nodulation and symbiotic nitrogen fixation, primarily through its effect on the nitrogen metabolism within the plant.

Molybdenum plays a dual role. Minute quantities are needed to permit nitrate utilisation in plants and greater quantities are required for symbiotic nitrogen fixation. On these soils the minute amount available from the soil was ample for nitrogen metabolism within the plant, but insufficient for symbiotic fixation. Applications of **lime,** by increasing the availability of the **Molybdenum** in the soil, appear to mask Molybdenum deficiency and on certain soils produce much the same results as are obtained from an application of **Molybdenum.**

Anderson is of the opinion that, although other methods may supply indications, Factorial Experiments are necessary to prove or disprove trace element deficiencies.

From the Molybdenum Experiment we went on to **"Gundaringa,"** a highly developed property near Crookwell, the property of Mr. C. E. Prell. The soil here is derived from granite, the rainfall 30-33 inches, and the deficiencies Phosphosus and Sulphur. The pastures we saw—Subterranean Clover and *Phalaris tuberosa*—were remarkably fine.

VISIT TO THE DICKSON EXPERIMENT STATION.

Here investigations are being carried out on some of the original indigenous Danthonia pasture, which has been largely replaced in the district by Subterranean Clover and Wimmera Rye. Under heavy grazing ($\frac{3}{4}$ sheep per acre) the persistent pasture is a mixture of *Danthonia semiannularis*, *D. auriculata*, *D. carphoides.*

The level of the leaves is about four inches, with flower heads up to eight inches to ten inches. Under sheep grazing this pasture is unharmed and very persistent—under a low stocking intensity it tends to be invaded by tall grasses—namely *Stipa bigeniculata* and *Stipa falcata.* In a good season it yields when clipped to ground level about one ton per acre. Interesting work is being carried out on the effect of different fertilisers and treatments on the composition of Subterranean Clover—Grass mixtures.

In plots which are top dressed with supers and grazed by bagged sheep (dung and urine removed), there is a complete dominance of clover and very little grass. On the other hand, in plots which are top dressed and grazed by sheep which are allowed

to deposit their excrement on the pasture, there is an abundance of grass. This appears to indicate that most of the benefit grass obtains from association with subterranean clover is derived from the nitrogen contained in the urine and faeces.

CANBERRA IN MAY.

Canberra is a lovely city—a city of trees—and in Autumn when I saw it, a city of colour; avenues of flaming Pinoaks, the golden glory of Poplars and Elms, and Liquid Amber, as lovely as its name.

It is a city that is being built to a plan, conceived before the first brick was laid, a unique mixture of the beauty of town and countryside; augury for the future of a vigorous and growing Dominion.

JOURNEY BY AIR FROM CANBERRA TO SYDNEY.

I left Canberra by T.A.A. Dakota on a lovely May morning. Long before we reached Sydney we were in thick cloud and rain. We circled over Sydney looking for a break in which to land and were vouchsafed tiny views of the harbour and city through dense white cloud. We came in low, very low, over many-storied buildings and put down in a soaking drizzle, and there was the C.S.I.R.O. again, represented this time by the ever helpful Mr. Andrews, the Sydney Publicity Officer.

I spent four days in Sydney and in that time, in addition to my visit to the University, I paid a lengthy visit to the headquarters of the New South Wales Department of Agriculture and spent a morning with H. B. Carter, the Officer in Charge of the Wool Biology Laboratory. Carter had recently returned from a trip to South Africa, and we spent a very pleasant and interesting morning drawing comparisons between things African and Australian. A very interesting morning was spent with the Chairman of the Australian Meat Board.

On the afternoon of Sunday, April 14, I was picked up at Hornsby by Dr. Davies and taken on to New England by car. This was a lovely journey along the Pacific Highway which, through Gosford, Wyong, Swansea to Newcastle, winds its way along bush-covered divides, with the most wonderful views of fiords, rivers and land-locked sea lakes. At Newcastle we turned inland on to the New England Highway, through Maitland, where we supped, and on through Singleton to Muswellbrook, where we slept.

Muswellbrook is on the Hunter's River, of Hunter's River Lucerne fame. Four miles south of Scone next morning we paused to photograph and examine some of the natural subclimax grassland—it consisted of *Stipa aristiglumis*, *Stipa variabilis*, *Danthonia* sp., *Chloris* sp., *Cynodon dactylon* (a little), *Paspalum dilatatum* (a little), *Tragus* sp., and at least three species of Bur medic.

The rainfall here is 33 inches and the carrying capacity two sheep to the acre. The country is largely devoted to thoroughbred studs and to cattle. We continued on through Scone, Wingen, Blandford, Murrurundi to Tamworth, fertile mixed farming country.

South of Tamworth we passed through wheat fields and saw lucerne under irrigation from tubes put down into the river alluvium around the town itself. Just north of Tamworth, on the edge of the New England Escarpment, is the Moonbi Lookout, a large granite boulder which affords a lovely view of the Peel Valley.

We arrived in Armidale at about 4 o'clock in the afternoon, and drove straight out to the C.S.I.R.O. Laboratory in the grounds of the New England University College to make contact with Mr. Ian Johnstone, the Officer in Charge of the **Regional Pastoral Laboratory,** and Mr. Dick Rowe, the Senior Pasture Research Officer.

THE NEW ENGLAND TABLELAND.—THE COUNTRY AROUND ARMIDALE.

The New England tableland lies at altitudes varying from about 3,300 to 4,500 feet, which for Australia is very high indeed. Armidale is 3,333 feet above sea level; Guyra, a small town north of Armidale, is 4,330 feet; and the summit of Ben Lomand, near Guyra, about 5,000 feet. The tableland enjoys a rainfall of about 31 inches evenly distributed throughout the year.

The climate is mild at Armidale the normal mean maximum temperature is 81.0 in January, the hottest month, and the normal mean minimum temperature 32.1 in July, the coldest month. Occasional falls of snow are experienced during the winter months.

The country around Armidale is rolling and fairly open with a very good cover of indigenous grasses. On the upland basalt of Kelly's Plain, near Mills' Farm, I noted the following species: *Poa caespitosa*, *Bothriochloa ambigua*, *Danthonia semiannularis*, *Themeda australis*, *Sorghum plumosum*, *Sporobolus indicus*, and *Panicum effusum*.

Tuesday, May 16, I spent with Mr. Jock Grantham, the District Agrostologist. Mr. Grantham is stationed at Armidale and serves the surrounding area in the way that an Extension Officer does here. Our first call was on a businessman who is developing a large trade in Hybrid Maize Seed derived from American inbreds. We then visited a small mixed farm, where we saw some very fine apple orchards and a small privately operated packing shed. Mr. Mills, the owner, had White Clover —*Phalaris tuberosa* pastures and grew turnips and oats as well for his stock.

We took a roundabout route back to Armidale, visiting on the way a farm where the pastures were Red Clover—*Phalaris tuberosa*. After lunch we travelled north through Guyra, which is on a plateau about 1,000 feet higher than Armidale. This is a

seed potato growing area. Potatoes, peas and oats are important crops. Near Guyra is a small lake known as the "Mother of Ducks," an oddly picturesque name of which no one seemed to know the origin.

Beyond Guyra we turned in to "Urandangie," a very fine and highly developed property belonging to Mr. Dutton, where we saw very fine Hereford steers on Rye grass—White Clover pastures. It was interesting to compare this very fine pasture with the condition of a neighbouring property across the boundary fence, where the original indigenous grassland, riddled by rabbits, showed up in startling contrast. Mr. Dutton told us that some of his pastures had been down for over 20 years.

Rabbits are the major limiting factor in this country, and improvement is impossible until they can be controlled. The accepted method is rabbit-proof fencing of paddocks, combined with constant hunting, ploughing up of warrens, etc., etc. I was told that Ferguson tractors, being so manoeuverable, were proving very useful in these operations.

THE REGIONAL FIELD STATION.

May 17 was spent on the Pasture Investigations at Cheswick, the **Regional Field Station.** It was quite a field day, the party including Dr. Davies and Bill Bruce from Canberra, I. L. Johnstone, the Officer in Charge of the Regional Laboratory and Field Station, R. Roe, Senior Research Officer, Agrostology (Natural Pastures), E. J. Hilder, Research Officer, Agrostology (Planted Pastures), and others. The organisation of this station is similar to that of the Regional Station at Deniliquin. The work is co-operative and the staff is drawn from the different divisions of C.S.I.R.O. concerned in the investigations—in this instance the Officer in Charge was a Veterinary Surgeon from the Division of Animal Health and Production.

The Pasture Investigations include:—

(1) **Studies in the Management of Natural Pastures** and experiments involving a comparison of different rates of stocking, and continuous versus rotational grazing are being carried out. The species composition of the natural Grassland is: *Bothriochloa ambigua*, *Eragrostis trachycarpus*, *Panicum effusum*, *Danthonia semiannularis*, *Themeda australis* (rare), *Enneapogon* spps., *Sedges* (*Shinus*), *Poa caespitosa*,—a little *Aristida ramosa*, Desmodium, Medic. (*Aristida ramosa* is sometimes dominant on the soils derived from granite.)

A study is being made of the effects of the different treatments on:—

(a) Infection by internal parasites.
(b) Wool production.
(c) Liveweight and Growth of Sheep.
(d) Yield and botanical composition of pasture.
(e) Chemical composition of the pasture.

As the work had only recently been commenced, no results were apparent, but preliminary botanical analyses results were interesting. The yield of air dry fodder from quadrats clipped

at ground level (very much more than would be obtained in cutting hay) was less than one ton per acre for the 1948-1949 growing season. The approximate composition by weight of the green material was 90 per cent. grass, 1 per cent. legumes, and 9 per cent. miscellaneous species (forbs).

Interesting, but still confusing, are the results being obtained in an investigation designed to study the relation between distance covered by grazing sheep and size of paddock. The technique employed in this investigation is very ingenious. The position of marked sheep is fixed at definite intervals by the intersection of bearings taken on them from several plane tables at different points. In order to be able to do this at night, the sheep are marked by torches strapped to their backs.

(2) **Species Trials:** This involves the preliminary testing of a wide range of forage grasses and legumes in nursery plots. Among the plants under trial and doing well was Sheep's burnet, *Poterium sanguisorba.* At Keith, in South Australia, I had noticed that the Evening Primrose, *Oenothera* sp., was included in pasture mixtures.

(3) **Fertiliser Trials:** Experiments have so far failed to show any minor deficiencies. On a *Phalaris tuberosa*, red clover and subterranean clover pasture, better results were obtained from two applications of superphosphate, one in the Spring and one in the Autumn, than from a double dressing given in Autumn.

(4) **Pasture Establishment Studies:** In a trial of methods of establishing a *Phalaris tuberosa*, Red Clover and White Clover mixture, better results were obtained from drilling at 7 inch row spacing than from broadcasting, cross drilling with 7 inch row spacing and drilling alternate rows at 7 inch spacing of Phalaris and Clover.

BALD BLAIR.

On Thursday, the 18th, we visited "Bald Blair" (Colonel White's very famous property) and the adjoining property owned by his nephew, Mr. George White. Together these two properties cover a big stretch of high, rolling country, and include a fair proportion of steep slopes and rocky hills. Practically all of the bottom and much of the hillsides is already down to highly productive grass clover pasture carrying beef cattle and Romney Marsh sheep. The pasture development is being carried up the steepest slopes and on to the hill tops, and it was plain to see that the time was not far distant when every inch would be under improved pastures. The means of development is an intelligent use of the half-sowing custom formerly prevalent in the Cape. Potato growers clear and plough the land for the crop of peas and the crop of potatoes they are allowed to take. These crops are fertilised, and when the potatoes have been dug the land is in good condition for the establishment of pasture. It is dressed with 90 lbs. of Superphosphate and seeded with a mixture consisting of 4 lbs. of cocksfoot, 1 lb. White clover, ½ lb. Perennial Rye per acre. The potato grower shifts on to a new patch which in its turn will be seeded down in three years time.

Colonel White uses other mixtures too. We saw stands which had been seeded with 3 lbs. of *Phalaris tuberosa*, 2 lbs. Red Clover, 1 lb. White Clover, with Rape as a cover crop. Promising results were being obtained from an inclusion of Timothy on some of the steep slopes.

From Bald Blair we carried on to some establishment experiments on a farm in granite country with a very fine sandy soil. In places I noticed *Themeda australis* very dominant under trees, forming a Themeda grassland almost pure except for a little Sporobolus. Couch (*Cynodon dactylon*) and *Eragrostis* spp. dominated on old fallows. *Paspalum dilatatum* and *Sporobolus* sp. were conspicuous along the road sides.

From Bergen's we continued to Glen Innes, where I remained while the rest of the party returned to Armidale.

GLEN INNES AND TENTERFIELD.

Glen Innes (3,520 feet above sea level) is in country very similar to that around Armidale. There appeared to be more cultivation, however, and I saw a fair amount of maize which had already been harvested.

I spent the night of Friday, May 18, in Glen Innes and next morning met the local representatives of the State Agricultural Department, Messrs. Powell and Noonan, the manager of the Experimental Farm and the District Agronomist and Mr. Bill Single, the wheat breeder. Messrs. Powell and Noonan had arranged a visit to Deep Water Station, beyond Tenterfield, the property of Mr. Pat MacCanch. Tenterfield at 2,831 feet, lies a good deal lower than Armidale, Guyra and Glen Innes, the annual average rainfall, however is much the same.

Deepwells Station was originally a very large leasehold property, but had recently been cut down to provide land for returned soldiers. The present farm was freehold and devoted mainly to beef cattle and wool sheep. The policy being followed was to plough back each year as much of the wool cheque as possible in the establishment of permanent improved pasture.

The pastures were Phalaris with Clovers, and we were shown how run out pastures in which the indigenous Danthonia and other grasses were completely dominant with Phalaris present, but making a very small contribution to the yield, responded to ploughing which resulted in an almost complete rejuvenation.

MacCanch was allowing his older pastures to revert to Danthonia, in the knowledge that he could renew them at will by ploughing and top dressing, while he devoted all of his machinery and energy to the breaking of new land and the establishment of new pasture; his idea being to get the whole farm down while high prices and good profits lasted.

It was a very enjoyable day we spent at Deepwells in the company of a most interesting and amusing host.

JOURNEY TO CUNNAMULLA.

According to my original programme I should have gone on to Grafton and the North New South Wales coast to see Paspalum pastures and dairy cows, but because I was afflicted with an

intense desire to see some of the dry inland country, Dr. Davies readily agreed to organise a trip to the Gilruth Plains National Field Station in South Western Queensland.

We left from Glen Innes on the morning after my trip to Deepwells Station, and travelling almost due west passed through Inverell and Warialda, arriving at Moree at sundown.

The morning was overcast and threatening, but we hurried through breakfast and carried on to Collarenebri and then south west to Walgett, where we spent the night.

Next morning we resumed our western journey. The weather was still threatening and Roe decided to save distance by cutting across from Cato to Engonia, just south of Barringun. By taking this route we would avoid both Brewarrina and Bourke and save some 70 odd miles.

All went well until we reached the **Government Bore** near Correlina Station (sheep station).* Here we found the country flooded, and eventually we were forced to plough a weary way through mud back to Brewarrina, where we arrived so plastered from digging and pushing and putting on chains, that we looked more like Black Fellas than anything else. It rained and it rained —and this, mark you, was the dry country—till it seemed that there was no prospect of our ever getting out of Brewarrina.

Eventually we had a stroke of luck. The railway had a flat top truck ordered to remove a tractor. The tractor could not get to the station so we were able to load our car and leave by rail for Byrock. We travelled for a long way through Mitchell grass country which was completely flooded on both sides of the embankment. Then we got into the red sandy Mulga country, and it was dry, so at Byrock we were able to unload our car and to continue by road, through Nyngan to Trangie, where we slept. The road to Trangie Experimental Station was impassable, so we contented ourselves next morning by visiting Mr. R. J. Hutchings, the C.S.I.R.O. Technical Officer in Charge of the grazing investigations, who took us out to see some typical grassland and pasture on farms near Trangie, and then we continued through Gilgandra, Coonabarabran, Gunedale and Tamworth to Armidale.

The furthest west point reached on this trip was the neighbourhood of Engonia, north and a little west of Bourke, about 500 miles due west of the coast, between MacLean and Coffs Harbour.

The following data illustrate very plainly the great change in country from the coast, across the New England Tableland, and into the dry Western Plains:—

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* This was an artesian bore. The water spurted from a 6 inch pipe to a height of about 4 feet and was led away in an unlined furrow. These furrows are often of great length and the wastage from them must be enormous. There are signs that the draw on the water from the *Great Artesian Basin* which supplies water for stock over the whole 550,000 square miles of its area (area of the Union of South Africa 472,550 square miles) at present exceeds the natural recharge. There has been over the years a gradual drop in the water level and more than 700 bores in Queensland have already ceased to flow.

Locality.	Altitude.	Normal Mean Max. Temp.	Average Rainfall.
Clarence Heads (coast)	99′	74.5°	56.04″
Grafton (about 25 miles inland)	21′	80.2°	37.80″
Glen Innes (about 100 miles inland)	3,520′	68.3°	31.30″
Inverell (about 140 miles inland)	1,980′	74.5°	29.94″
Warialda	1,106′	79.6°	27.34″
Moree (about 240 miles inland)	686′	81.9°	22.92″
Collarenebri	477′	82.6°	18.54″
Walgett	436′	80.5°	18.05″
Brewarrina	392′	81.6°	15.19″
Bourke (about 500 miles inland)	361′	83.1°	13.53″

The journey provided a very good cross section through some of the most important natural pasture types. From the region of **Moist Temperate Perennial Grassland,** which reaches from the coast and covers the Tableland, we descended very quickly into the region known as the **Temperate Short Grassland,** which covers the country around Inverell and Warialda.

In this zone communities dominated by medium tall grasses such as *Bothriochloa ambigua*, the inferior and unpopular Red Grass, *Dicanthium humilis*, *Dicanthium sericeum*, Queensland Blue Grass and *Stipa aristiglumis*, Liverpool Plains Grass, were important and extensive.

The zone carries a very heavy sheep population, and it would appear that under use the taller grasses give way to the shorter Danthonia spp., which constitute a disclimax and earn for the zone in which they are important the name of **Temperate Short Grassland.** Dry Temperate Medium Grassland might be a better name for this region and would convey a better picture of the successional significance of the existing grassland communities.

Important species common, but not seen dominant in this region, were *Cymbopogon refracta* (Barbed Wire Grass), *Themeda australis*, *Themeda avenacia*, and *Poa caespitosa*. Mint Weed appeared to be a very serious pest on ploughed land. The zone includes a large part of the wheat belt of New South Wales, and around Inverell and Delungra we saw extensive areas of young wheat. Fields of Dwarf Grain Sorghum were noticed too. Callitris and Casuarina were conspicuous trees in the woodland around Warrialda, and there were patches of Boree (*Acacia pendula*) called Myall here. Other trees noted were several Acacia spp., including Brigalow, *Heterodendron oleofolium*, *Geijera parviflora*, and *Alstonia constricta*.

It was between Warialda and Moree that I saw my first Wedge Tailed Eagles. Near Moree we saw a fine stand of *Panicum antidotale*. This was on Crooble, the property of Mr. O. Uebergand. On the overgrazed stock route just out of Moree, *Acacia farnesiana* (introduced from Africa) was flourishing with *Bassia quinquecuspis*, a small indigenous shrub. This is a

typical example of thorn scrub encroachment and should be dealt with without delay. The Acacia appeared to be quite at home and may in time prove to be a very serious weed in the country to which it is suited.

West of Moree we travelled for some distance along a flood plain on which Colabar and Black Box were important trees. Noted, too, were groups of small Quinine Trees, *Alstonia constricta*, Supple Jacks, *Ventilago viminalis*, *Eremophila bignoniflora*, and a shrubby *Lyceum* sp. Flocks of Galahs were common and very lovely as they wheeled, revealing their beautiful pink under-parts.

Common grasses were *Thelungia advena*, a tall Sporobolus-like grass, *Sporobolus Carolii*, *Sporobolus Mitchelli*, and a *Digitaria* sp. There were small patches dominated by a tall Sorghum, and fairly extensive areas in which a *Panicum* sp., probably *Panicum decompositum*, was dominant.

About 25 miles east of Collarenebri we had entered the edge of the Mitchell-Flinders Grass Zone. Here *Astrebla lapacea* and *Panicum decompositum* took turns in dominance, while *Thelungia advena* and the annual *Iseilema membranacea*, Flinders Grass, were important associated species.

Beyond Collarenebri, large areas were dominated by Queensland Blue Grass, *Dicanthium sericeum*, with *Chloris acicularis* and *Sporobulis carolii* as important associated species. The tree vegetation here was very mixed and in addition to stretches of Colabar and Poplar Box, Wilga (*Geijera parviflora*), Leopard Wood (*Flindersia maculosa*), Belah (*Casuarina* spps.), Sandal Wood (*Eremophila mitchellii*), Emu Bush (*Apophyllum anomateum*), *Callitris glauca* and some Brigalow (*Acacia harpophylla*) were all noted.

About 25 miles out of Walgett (Boorooma Station) on the way to Brewarrina, Mitchell Grass country was entered again, an almost pure stand of Mitchell Grass (*Astrebla lappacea*) growing in very large tussocks, with a little Queensland Blue Grass, Chloris and Panicum on heavy black soils.

On the western edge of the treeless Mitchell Grass plains beyond the Brewarrina turn-off, we noticed small groups of Gidgee (*Acacia cambagei*) twelve to fifteen feet tall and in flower, and in the same locality small patches of *Eragrostis australasica* eight feet tall growing at the edge of a pool near the roadside. *Diphlachne fusca* was also seen. The Gidgee has a very unpleasant scent.

An indication of the effect of heavy overstocking was provided by a large denuded area caused by sheep concentrating near a watering point. Some of this area was almost completely bare, the only vegetation being a very sparse cover of *Sporobolus actinocladus*, *Chloris ventricosa*, various Chenopods and a small pink flowering malvaceous plant; further out the grassland was an almost pure stand of *Chloris ventricosa* on which sheep were grazing.

Beyond the Culgoa River, on a sandy red soil, we found a very mixed bush in which patches of Brigalow and Callitris

alternated with a mixed community which included Wilga, Iron Wood (*Acacia excelsa*), Gidgee, *Canthium* sp., *Eremophila sturdii*, Poplar Box, etc., etc. Due mainly I suppose to the depredations of rabbits, which were very abundant, there was very little ground cover, one of the most important grasses being *Perotis rara*, an annual with inflorescences up to six inches. South of Brewarrina on the rail journey to Byrock we noticed for the first time Barley Mitchell (*Astrebla pectinata*).

Mulga Scrub was encountered on the lighter textured soils north of Byrock and between Byrock and Nyngan. This is a mixed "bushveld" in which the Mulga (*Acacia aneura*), eight to twenty feet tall, is dominant. Other trees include Poplar Box, Kurrajong, Beefwood (*Grevillea* sp.), Ironwood (*Acacia excelsa*), Bloodwood (*Eucalyptus polycarpa*), *Eucalyptus intertexta*, Emu bush (*Apophyllum anomalum*), Wilga (*Geijera parviflora*), Supple-Jack (*Ventilago viminalis*), etc. The trees are widely spaced and between them the red sandy soil is sparsely covered by perennial and annual grasses. Prominent were *Themeda australis*, *Cymbopogon* sp., *Aristida jerichoensis*, *Eragrostis eriopoda*, *Eriachne helmsii*, *Danthonia bipartita*, *Neurachne mitchelliana*.

In years in which there is a fair amount of winter rainfall, herbaceous plants become conspicuous. Important are Crowsfoot (*Erodium cygnorum*), *Sida trichopoda*, etc., etc. This "herbage," as it is called, is regarded as a very important part of the grazing. Signs of damage due to overgrazing and lack of management were manifest in the abundance of Aristida, patches of bare ground, the apparent increase in the importance of a shrubby Cassia sp., Eremophila and Galvanised Bur (*Bassia Birchii*). The carrying capacity is very low, and I was told that the overall stocking was about one sheep to ten acres.

COUNTRY AROUND TRANGIE.

Important grasses noted in the natural pastures (Sheep disclimax) around Trangie (Rainfall 17.75") were *Chloris acicularis*, *Stipa falcata*, *Stipa setacea*, *Stipa aristiglumis* (on the heavy soils), *Enneapogon flavescens*, *Digitaria brownii*, *Digitaria coenecola*. The trees were *Callitris glauca*, Wilga and the ever-present Eucalypts.

The ringbarking of Eucalyptus spp. and *Callitris glauca* around Trangie has resulted in the production of extensive patches of Wilga parkland, a very attractive relic community. The Wilga trees afford good browse, and because they are kept neatly trimmed by the sheep around their boles, they present a flat-bottomed appearance like the toy trees which decorate model farmyards.

To be continued.

The Use of Hormone Weedkillers in Africa—South of the Sahara

By Dr. R. E. ALTONA,

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Africa, the Dark Continent, is one of the world's largest potential food producing countries which has yet to be developed. South of the Sahara lie millions of acres of unexploited virgin soil which one day will be producing food for an increasingly hungry world. Even so, from the tropics to its most southern point, Africa is producing to-day a large variety of agricultural products from a wide range of crops.

The agricultural methods employed are often primitive, with the result that production per unit area is low, but even where farming methods are modern, production compares unfavourably with other farming countries. One of the major causes of low crop yields is poor weed control. Weeds compete with crops for available plant foods, for moisture, for sunlight, and in the case of small grains they dirty the seed. The discovery of the new hormone weedkillers has given man a new and powerful weapon in his struggle against weeds. They are selective, they do not leave toxic residues in the soil, and are themselves not toxic to animals, only small quantities per acre are required for effective weed control, and they are labour saving.

When the new weedkillers were discovered research work was concentrated on finding out what weed species they would kill. Generally speaking, it was found that most broad-leaved plants were susceptible while the majority of narrow-leaved plants were tolerant or resistant. This meant that most crops belonging to the grass family could be sprayed with a hormone type weedkiller without damage to the crop, while broad-leaved weeds present in the sprayed lands would be killed. Now the emphasis of research work is on the tolerance or resistance of various crops to the weedkiller. To-day we know that even susceptible crops and weeds have stages in their growth cycle when they show maximum tolerance, while resistant crops and weeds have stages when they are least resistant. Climatic and soil factors also have a large bearing on the success or failure of the weedkillers. Because of all these uncertainties careful research work is essential before large scale use of the weedkillers on specific crops can be recommended. There is little knowledge on the reaction of many tropical crops to the new weedkillers, and this wide field awaits scientific investigation.

To many people the term "selective weedkiller" means nothing more than the chemical 2,4-D. This chemical in its many formulations is only one of a host of selective weedkillers. MCPA or Methoxone is more widely used in England and on the Continent

than is 2,4-D, while the latter weedkiller is more popular in the U.S.A. Besides these to, phytotoxic oils, 2,4,5-T, Dinitro products, P.C.P., T.C.A., I.P.P.C., and Cyanamides are but a few of the products now used for a wide range of weedkilling purposes.

Very little research has been done in Africa on these new weedkillers, and in practice only a comparatively small acreage is sprayed annually by farmers to control weeds. The crops grown in this large continent cover a wide range and offer a large field for investigation. In the wheat fields of the Western Province of the Union of South Africa, selective weedkillers are being used in ever increasing quantities, while the idea is becoming popular among the maize farmers of the Union.

There appears to be a place for the right type of weedkiller, applied at the right time, in almost every type of crop. However, it must be borne in mind that these weedkillers at their best are only an aid to the cultivation practices normally carried out for weed eradication. Only in rare instances will one spraying of weedkiller be sufficient to keep the crop area clean from weeds during the entire growth period of the crop. Before using these new weedkillers the user must make certain that the type or form selected will not damage the crop rather than merely look for a weedkiller to kill as many weeds as possible. One crop failure is far more serious than failing to obtain the desired kill of the weed population. Closely related crops are not necessarily equally resistant. Because maize is tolerant to 2,4-D one might automatically assume that sorghums are also tolerant. Experiments have shown that sorghums are very susceptible at certain growth stages and indiscriminate spraying might cause a total crop failure. Grain sorghums are more susceptible than are forage sorghums. Breeders of hybrid maize must also exercise care when using 2,4-D on inbred lines, as there is a varietal difference in tolerance.

Linseed is another crop that can be severely damaged by applying weedkiller at the wrong time. Between the heights of 4 to 10 inches the plants are reasonably resistant, but spraying at an earlier or later stage will injure the linseed. In the application of weed control to flax, totally different considerations apply since maximum fibre production takes precedence over seed yield. 2,4-D cannot be used, as it damages the fibre. The dinitros can be used, but only the sodium salt and then only at a fairly low concentration.

Many crops which are susceptible when they are up can be sprayed with comparative safety before they appear above the ground. The use of weedkillers on potatoes has a promising future, as the weed growth along the hills in particular can be checked, eliminating the laborious hand-hoeing that is often necessary. This crop should be syrayed as near to emergence as possible, as it suffers least damage at this stage. Once the crop is up spraying is dangerous unless the plants are protected. Pre-emergence spraying has also proved successful in many vegetable crops. In heavily mulched soil spraying of onions just before they emerge gives good weed control with little, if any, damage being done to the onions. On the other hand, pre-emergence

spraying of the same crop at the same time but on a sandy soil can be fatal. The reason is that on a light soil the weedkiller is leached down to the roots of the onion plants, while in the mulch little leaching occurs.

Weeds in coffee plantings have been successfully controlled with a combination of weedkillers. Normally the weeds are controlled by slashing or shovelling, and these operations may be performed two to six or more times each year. These operations may be cut down to as low as one per season if chemical weedkillers are applied after the initial slashing or shovelling treatment. In cotton fields aromatic oils show promise without injury to the cotton plants, provided the spray only comes in contact with the stems. Where picking is carried out by machine certain hormones can be used as defoliants.

Tobacco is another crop that cannot be sprayed, as the plants are most sensitive to weedkillers. However, there are great possibilities for their use in weed control in seed beds. The safest method is to prepare the seed beds in autumn and spray the beds a few days after preparation or when the weeds appear above the ground, depending on the type of weeds. If grass weeds are most common, then spraying must be done before they appear above the surface of the soil. This treatment will leave the seed beds relatively clean for sowing of tobacco the following spring, by which time the weedkiller will have been leached out of the top few inches of soil or entirely destroyed by bacterial activity. The germinating tobacco seeds should then be perfectly safe. It is also possible to spray the seed beds a few weeks before sowing in the spring. Before doing this, however, experiments must be conducted to find out how long the weedkiller persists in the soil. Persistence depends on a number of factors such as soil type, amount of organic matter present, rainfall and climatic conditions in general. Groundnuts are another crop that can be sprayed before emergence, but not after the plants have appeared above the ground.

Bush eradication is another important problem that warrants careful consideration. Removal by machine or hand is often a costly business. Chemical weedkillers show promise of solving many problems, but there still remains much research work to be done in this line before eradication of all species can be achieved.

The potential of these new weedkillers is tremendous and only the surface has been scratched. On the continent of Africa only a little research work has been carried out and the scope is vast. Unfortunately, a little knowledge is a dangerous thing when it comes to using these weedkillers, and wrong timing or amount or type applied might result in a complete crop failure. Farmers should be sure they have been given reliable information before using any of these new chemical weedkillers, and then they must follow instructions implicitly. Reliable information only comes from painstaking research, the rest is mere guesswork and may prove costly to the unwary user.

The wilted maize in the centre foreground of this untreated control plot is due to severe weed competition. The flourishing maize in the surrounding land was sprayed with the Amine Salt of 2,4-D, and 30 days later was given one cultivation.

[Photo. by courtesy of "Rhodesian Tobacco Journal."

This plot was not sprayed but was given one cultivation. Control of weeds was obtained in the row but not between the plants.
[Photo. by courtesy of "Rhodesian Tobacco Journal."

An excellent example of weed control obtained by applying the Amine Salt of 2,4-D, 5-7 days after planting, followed by one cultivation. Note the absence of weeds between plants as well as between rows.

[Photo. by courtesy of "Rhodesian Tobacco Journal."

Tsetse Fly in Southern Rhodesia, 1950.

By J. A. WHELLAN, B.Sc., F.R.E.S.,
Entomologist, Division of Agriculture and Lands.

There has been little change in the Tsetse Fly position during the year except in the Mtoko District. The effective methods of control used for many years have been continued. Against *G. morsitans* Westw. game reduction operations have been carried out in the northern areas and in the Sabi Valley, coupled with Traffic Control where roads traverse Tsetse Fly Belts, while against *G. pallidipes* Aust. and *G. brevipalpis* Newst. the barrier clearing on the Eastern Border of the Colony has been maintained and slightly extended.

The most disturbing occurrence of the year has been the admance of tsetse, *G. morsitans*, from Portuguese East Africa into the Mtoko District. This advance is dealt with in more detail later in this report.

In the Urungwe Native Reserve there has been an outbreak of animal trypanosomiasis, the first for several years. This outbreak was probably caused by the failure of the Natives inhabiting the Reserve to observe the advice given them as to where it was safe and where dangerous for them to keep cattle. Although there have been rumours of tsetse fly occurring in the Reserve, these have not been substantiated. There is at present no reason to believe that any advance of tsetse has occurred in this area.

In the Hartley District there have been no reports of tsetse east of the Umniati River. Settlement of the Sanyati Native Reserve has proceeded and there has again been no suspicion of trypanosomiasis, either animal or human, in the District.

In the Sebungwe District an area of approximately 250,000 acres, much of which was formerly infested by tsetse, in the south-east of the District, has been taken over for development by the Native Department. The north-west of this area overlaps the present tsetse fly belt, but the southern and south-eastern part of the area is sufficiently far removed from tsetse to render any major trouble from trypanosomiasis unlikely. Accordingly, this area is being settled first.

In the Sabi Valley there remains a high concentration of *G. morsitans* in Portuguese East Africa, close to the Southern Rhodesian border north of the Sabi River. South of the Lundi River there is an unconfirmed report that *G. morsitans* has crossed the border into Southern Rhodesia in small numbers. This remains to be investigated. In all other areas the position shows little change since 1949.

Cases of human trypanosomiasis numbered seven (including one European), and in addition one Native died from the disease in September, 1949, but this was not reported until 1950. This Native contracted the disease in 1946 and the case was recorded in that year's total. The number of cases thus remains much the same as the average over the past few years.

A considerable amount of new road was constructed during the year in the Lomagundi, Hartley and Sebungwe Districts, bringing the total length wholly or partly constructed and maintained by Tsetse Fly Operations, or through its vote, to approximately 500 miles.

Conferences and Committees.

The second meeting of the International Scientific Committee for Tsetse and Trypanosomiasis Research was held at Antwerp from 20th to 23rd June. For financial reasons the Southern Rhodesian members of this Committee were not allowed to attend.

The writer attended the Fauna Conference held at the Victoria Falls from 18th-19th September, at which representatives from East, Central and South Africa were present.

The first of a proposed series of joint meetings of Tsetse Fly Workers from the three Central African Territories was held in Southern Rhodesia in June. This was principally a field meeting, in the course of which many informal but useful discussions on Tsetse Fly were held and the work in progress on the Eastern Border inspected.

Three full meetings and three special meetings of the Southern Rhodesia Trypanosomiasis Committee were attended.

Personnel.

The two Beit Research Scholars commenced their training in East Africa at the beginning of the year.

Destruction of Game.

This report covers the period January 1st to September 30th, 1950, only, and so no comparison can be drawn between the figures for this period and those for previous years. Since climatic conditions vary from month to month, it cannot be assumed that in nine months approximately three-quarters the number of game would be destroyed in comparison with a full year. The same objections apply to comparisons of the numbers of tsetse fly caught on traffic control operations, while no figures are available for the numbers of cattle in several districts, as these are compiled by other departments working to the calendar year.

During the period a total of 19,491 animals were destroyed with an average of 2.25 rounds of ammunition used per animal. The number of each species destroyed was as follows:—

Elephant	5	Reedbuck	476
Rhinoceros	6	Bushbuck	1,297
Buffalo	335	Duiker	5,280
Zebra	219	Warthog	2,836
Eland	225	Bushpig	595
Kudu	3,143	Baboon	1,394
Roan antelope	142	Lion	1
Sable antelope	891	Leopard	13
Waterbuck	340	Cheetah	3
Hartebeeste	45	Hyaena	9
Tsessebe	58	Wild Dog	8
Impala	2,170		
	Total	19,491	

SHORT ACCOUNT OF THE TSETSE FLY SITUATION IN EACH DISTRICT.

Mtoko.

As mentioned earlier, the extension of range of *G. morsitans* from the east into this area has been the most disturbing feature of the year's work. This species was not known to occur close to the Southern Rhodesian border in this area until November, 1945, when it was found sparingly on the Ruenya River, near Changara in Portuguese East Africa. A brief survey made in 1947 gave no grounds for supposing that its range was extending. Then in 1948 a survey established that its range had extended considerably to the northward, just reaching the main Mtoko-Changara road but extending no further west along this road than a point 18 miles east of the Southern Rhodesia-Portuguese East Africa boundary, while further south it had extended to within five miles of this boundary which here limits the Chikwizo Native Reserve. During 1949 there was no evidence of any further expansion and the position, as judged by the number of animal trypanosomiasis cases occurring in the Mkota and Chikwizo Native Reserves, appeared to have eased. It therefore came as something of a shock when, following upon a marked resurgence of animal trypanosomiasis in the area, a preliminary investigation made in June, 1950, established that *G. morsitans* had spread so rapidly westwards along the main road that it was firmly established only three miles east of the international boundary, while occasional tsetse were taken on the main road up to as much as 12 miles west of the international boundary. An extensive survey was therefore carried out from July to September in order to ascertain whether *G. morsitans* was established in Southern Rhodesia in this area and, in particular, whether it occurred away from the main road in localities where it was unlikely to have been carried by traffic. *G. morsitans* was found so regularly at a point on the main road, half a mile west of the international boundary, that it seems likely to be breeding there in small numbers. The evidence indicates that the flies found further west than this on the main road have been carried by traffic. Very few tsetse have been caught, and at two places only, away from the main road. One of these localities is the south-east corner of the Mkota Reserve, where a well-used native path enters the Reserve from Portuguese East Africa. The indications are that the flies caught here have been carried by Natives. The other locality is on and near the Mudzi River, about 10 miles west of the international boundary. This is close to a minor road, so that these flies also may have been carried by traffic, but it is also possible that the flies have spread naturally westwards along the Mudzi River. Despite protracted search, however, no tsetse were found further east along the Mudzi River. This river system will be the subject of further investigation. Throughout the area involved, tsetse are very sparsely distributed and therefore difficult to find, so that it is hard to obtain a clear picture of the situation.

Three traffic control points have been established, one on the main road close to the border, one on this road about 10 miles west of the border, and one where the native footpath enters the

south-east corner of the Mkota Native Reserve. It is too early yet to make any inferences from the observations at these control points.

Darwin.

Except close to the Portuguese Border tsetse, *G. morsitans*, are now very scarce in this area. Despite search, none has been found on the Sowe and Kadzarui Rivers, where in recent years there has always been a small number. This area will be especially searched in the next year, as *G. morsitans* is difficult to find when it is present in only low density. Away from the Portuguese Border Tsetse are now only to be found in the neighbourhood of the Utete River and its tributaries.

Game also is very scarce in the area. There is one small herd of Elephant which regularly frequents the area and Duiker and Baboons are quite numerous, but other species are much less frequently encountered.

Zambesi Valley (Hunyani).

There is very little change in the tsetse fly position in this area. *G. morsitans* remains plentiful on the lower Angwa River for the last 10 miles of this river's course in Southern Rhodesia. On the Kadzi River tsetse are now seldom seen, but they remain in fair numbers on the other river systems in the area below the Zambesi Escarpment. As has been the case for some years now, no tsetse have been seen above the Escarpment.

There is still a fair quantity of game in this area, particularly Elephant, Black Rhinoceros, Greater Kudu, Bushbuck and Buffalo, which, in the dry season, occurs mostly on the Angwa and Hunyani Rivers which are the only perennial rivers.

Urungwe.

There is little change in the general tsetse fly position to report from this area. No more tsetse, *G. morsitans*, have been found on the Mtshowe River, or elsewhere outside their normal haunts, while in the triangle formed between the Naodsa and Gachegache Rivers the density of tsetse has greatly decreased. A reduction in density has also been observed between the Chipura River and the western edge of the Urungwe Native Reserve.

Tsetse still occurs all along the northern and western boundaries of the Urungwe Native Reserve, and extends for a few miles into the Reserve about the middle of its western boundary.

Two outbreaks of animal trypanosomiasis have affected the Urungwe Reserve, resulting in the deaths of some 500 head of cattle. The first affected only one kraal in the north of the Reserve where the owner allowed his cattle to stray down to the Naodsa River. 80 of the total of 83 cattle died as a result. Since then there have been no further cases of animal trypanosomiasis in this part of the Reserve. The second outbreak was on a larger scale, affecting mainly the south-western part of the Reserve. It is thought that settlement too far to the west, with consequent straying of cattle into areas of Tsetse infestation, was the cause of

this outbreak. The cattle in the affected area were injected with Dimidium Bromide under the supervision of the Director of Veterinary Services, and game destruction has been intensified between the Reserve and the Sanyati River. A long-term policy designed to prevent such outbreaks in the future has not yet been decided upon as all the necessary information is not yet available.

Game in general is rather scarce throughout this area, Duiker, Warthog, Bushbuck and Greater Kudu being the most plentiful species, while Sable are more numerous than in most other areas.

Chirundu.

After a more or less normal wet season, the numbers of Tsetse caught at the traffic cleansing posts on the Miami-Chirundu Road in general showed some decrease over the abnormally high figures recorded last year. Taking into consideration the further increase in traffic (the vehicular traffic at Chirundu increased 80 per cent. over the 1949 figure and smaller increases occurred at other main road stations), these figures probably indicate a return to something like normal conditions after the abnormal dry season of 1949. It is difficult, however, to make any comparisons with earlier years from figures such as these as both traffic and numbers of Fly caught tend to increase annually (see Traffic Control Section). Thus the relationship of the present position to that in 1948 cannot be readily assessed, but it would seem that the general position in the area remains more or less stable, to which end the operations being carried out are at present directed.

Game is scarce in the area, the most numerous species being Warthog, Impala, Duiker and Greater Kudu.

Lomagundi S.W.

Thee is no change to report from this area. *G. morsitans* occurs rather sparingly in the area between the Mongalhowe and Umvumvudzi Rivers, the latter being the western boundary of this area of operations. No tsetse have been found east of the Sanyati River in this area.

No cases of trypanosomiasis have occurred anywhere in the area.

Game is, in general, scarce, Greater Kudu, Duiker and Warthog being the only species which still occur in fair numbers.

Hartley.

There were no reports of tsetse anywhere in the Hartley District and, with the successful development of the Sanyati Native Reserve and the absence of any suspicion of trypanosomiasis in the considerable number of cattle now running there, it may be presumed with some confidence that tsetse has been finally eliminated from this District. Occasional cases of trypanosomiasis could still be caused, however, by tsetses carried with game from the western side of the Umniati River.

On the west of the Umniati River, in the Sebungwe District, tsetse, *G. morsitans*, have been driven back, and do not now occur

within 10 miles of the river except for very occasional flies found a few miles lower down the Ungwe River.

While generally scarce, game tends to congregate near the Umniati for water towards the end of the dry season. The most plentiful species are Duiker, Greater Kudu and Warthog.

Sebungwe.

There has been little change in the general tsetse position in this area. One fly, *G. morsitans*, was caught near the headwaters of the Dongamusi River in April, a considerable distance south-west of the present distribution area of this species. It was near a native footpath, and as no more Tsetse have been found in this locality, despite intensive search, may be presumed to have been carried. No tsetse were found on the Mzola River or anywhere else in the south of the area. There appears to have been no improvement in the position on the Nagupande, Lutope and Sengwa Rivers, but fly densities are a little lower at Chebira and Muzaza Hill. Further to the north tsetse remains dense on the Lubu and Lungwalala Rivers and at Sinisitonka's and Tiwuli Spring. These appear to be the main dry season foci of *G. morsitans* in this area. This is to be expected, as these localities carry water perennially and are points at which game concentrates in the dry season.

An investigation was carried out in July to the west of the area along the Sebungwe River to its confluence with the Zambesi River. This area is outside the zone of the present operations, but it is of interest in that it has apparently always been free of tsetse in this century. No evidence of the presence of tsetse was found on the last 12 miles of the course of the Sebungwe River. During this investigation a special effort was made to find *G. pallidipes*, which has been found in two localities in the area previously. This effort was unsuccessful, but a Native brought into the camp a specimen he had caught some six weeks previously. It would seem that the real home of *G. pallidipes* in the area has not yet been discovered.

There is probably more game, belonging to a wider variety of species, in this area than in any other area where Tsetse Fly Operations are carried out. Buffalo in particular are more numerous than elsewhere and, although 115 head were shot, this probably represents little more than the natural increase of these animals in the area and there is no apparent diminution of their numbers. Elephant are in considerable numbers and Black Rhinoceros are not infrequent. Neither of these species is shot on Tsetse Fly Operations. Of other game animals, Duiker, Impala, Greater Kudu and Warthog are the most numerous.

Two cases of animal trypanosomiasis were recorded in cattle on the Dongamusi River, close to the place where the one, presumably carried, tsetse was caught. No cases were reported elsewhere in the District although, in several places, cattle live close to the present limits of tsetse. The area between the Kana and Lutope Rivers, part of the 250,000 acres taken over by the Native Department, is now being developed and settled. As this area is not

very far from the present southern limit of tsetse, it will not be surprising if some cases of trypanosomiasis occur but, as the cattle will be under close veterinary supervision, such outbreaks, if they do occur, should be on only a very limited scale.

Eastern Border (Chipinga).

The total extent of the protective clearing in this district is now 59,500 acres. A small area of new clearing, amounting to 50 acres, was made during the period. Regrowth was cut on over 46,000 acres of the clearing. The progress towards semi-natural grassland continues. Over an extensive area of ground on and about Grampians the grass *Loudetia simplex* (Nees) C. E. Hubbard is now dominant, various herbaceous plants being the only other species forming an appreciable part of the vegetation.

The clearing was not burnt during the period under consideration, as climatic conditions made it appear advisable to defer buring until October.

Sixty-two cases of animal trypanosomiasis involving 10 farms were diagnosed in the District. This figure does not differ significantly from the totals for 1949 and 1948, 87 and 96 respectively, in view of the fact that these latter figures concern 12-month periods. No major outbreak occurred, but two of the farms, Lettie Swan and Houtberg, had 23 cases each.

One additional case occurred on a farm north of the Lusitu River (Melsetter District).

Fifty-three Tsetses were caught in and near the border clearing. Three of these (two *G. brevipalpis* and one *G. pallidipes*) were caught in Southern Rhodesia close to the international boundary, the remainder in Portuguese East Africa.

Of the total number, 24 were caught in traps, namely, 5 *G. morsitans* and 19 *G. pallidipes*. The remaining 29, caught on man or while resting on paths, comprised 4 *G. pallidipes*, 24 *G. brevipalpis* and 1 *G. morsitans*.

Two intensive surveys were made on the uncleared portions of the farms Houtberg and Farfell to find out whether tsetse might have crossed the clearing from the infested woodland in Portuguese East Africa, and so be responsible for the animal trypanosomiasis cases in the vicinity. No tsetse were found however.

Sabi Valley.

There is no change to report in the tsetse fly position in this area. *G. morsitans* remains plentiful in Portuguese East Africa, close to the Southern Rhodesian border, especially on the Honde and Ndanga Rivers. Rather more tsetse have been caught in the neighbourhood of these rivers in Southern Rhodesia than in previous years, but all have been very close to the international boundary and there is no evidence of any advance of tsetse in this neighbourhood. A report that tsetse have been found south of the Lundi River some 8 miles north-west of the international boundary awaits confirmation.

No cases of trypanosomiasis have been reported from this area.

Elephant are plentiful in the southern part of this area, where they are not shot in connection with Tsetse Fly Operations. Greater Kudu and Duiker are otherwise the most plentiful game animals and Buffalo occur in fair numbers. Other animals are, in general, scarce.

TRAFFIC CONTROL.

Three new traffic cleansing posts were established at the end of the period, all being in the Mtoko District, in an effort to counter the westward carriage of *G. morsitans* by traffic from Portuguese East Africa. No figures are yet available from these posts.

Shortages of materials have delayed the erection of the cleansing chamber which it was hoped to place at Makute, but it will be built as soon as possible.

The following traffic was examined at the Urungwe District control points. In comparing the figures with those for previous years it should be remembered that these, except where stated, concern 12-month periods.

Vuti Gate.

2,745 cars bringing	10 fly (9 male, 1 female).
1,074 pedestrians, 297 cyclists (502 parties) bringing	9 fly (6 male, 3 female).
Total	19 fly (15 male, 4 female).

Compared with 1941 (67); 1942 (49); 1943 (56); 1944 (27); 1945 (29); 1946 (23); 1947 (20); 1948 (11); 1949 (17).

Catkin Chamber.

111 cars bringing	16 fly (11 male, 5 female).
1,699 pedestrians, 699 cyclists (982 parties) bringing	69 fly (56 male, 13 female).
Total	85 fly (67 male, 18 female).

Compared with 1944 (5 months only, 15); 1945 (61); 1946 (37); 1947 (28); 1948 (34); 1949 (91).

Makute Gate.

2,911 cars bringing	455 fly (386 male, 69 female).
1,121 pedestrians, 624 cyclists (1,008 parties) bringing	642 fly (531 male, 111 female).
Total	1,097 fly (917 male, 180 female).

Compared with 1944 (4 months only, 100); 1945 (562); 1946 (703); 1947 (764); 1948 (504); 1949 (1,718).

In addition, records were kept for the first time of tsetse carried by vehicles travelling northwards. A very similar amount of traffic carried 43 tsetses (39 male, 4 female). These tsetses probably in part represent flies established a little way south of Makute Gate and in part flies which fly off vehicles travelling southwards and stopping at the gate and which are not immediately caught.

Chirundu Gate.

2,804 cars bringing	141 fly (106 male, 35 female).
1,796 pedestrians, 312 cyclists (651 parties) bringing	148 fly (111 male, 37 female).
Total	289 fly (217 male, 72 female).

Compared with 1941 (119); 1942 (276); 1943 (746); 1944 (437); 1945 (485); 1946 (incomplete, 319); 1947 (211); 1948 (214); 1949 (658).

Midway Barrier.

70 cars bringing	38 fly (31 male, 7 female).
3,977 pedestrians, 231 cyclists (1,353 parties) bringing	115 fly (87 male, 28 female).
Total	153 fly (118 male, 35 female).

Compared with 1949 (170, 6 months only).

The Cooling of Milk

By THE DAIRY BRANCH.

Due probably to the recent milk price increases, numerous farmers have become interested in the delivery of fresh milk to the cities.

The majority of interested farmers have been those who are either just commencing farming operations or those with only a limited amount of milk for disposal.

One of the problems facing such small producers—in order to make the proposition a more payable one—is to obviate the necessity for a twice a day delivery and thus cut these charges in half by delivering once a day only.

The suggestion invariably put forward by such producers is that the household refrigerator might well be used for cooling the night's milk. With such cooling, it is argued, the night's and morning's milk could then be delivered in one consignment.

Unfortunately such a method of cooling is completely unsatisfactory, and if adopted will result in "sour" returns from the dairy, with consequent loss to the farmer.

To ensure the effective cooling of milk, it is essential that it be cooled to at least 50 degrees F. or lower within an hour or two after production. This result can easily be achieved by passing the milk over a refrigerated surface cooler or by standing the milk in the water of a refrigerated immersion type cooler. In either of these two methods, the desired low temperature is reached in a very short space of time, as the milk in both cases comes in direct contact with the refrigerated medium with the result that cooling is almost immediate. In the case of the household refrigerator cooling is effected by exposing the surface of the can of milk to the cold air inside the refrigerator. This method of cooling, whilst perhaps perfectly satisfactory for cooling a pint or two of milk for the farmer's requirements, is far too slow when a once a day commercial delivery is contemplated.

This method of cooling takes approximately twenty-five times longer than either of the two methods described above, with the natural result that souring is in progress whilst the milk is being cooled.

Unfortunately there is no alternative for the small producer —either deliveries must be undertaken twice each day, or one of the other methods of refrigeration adopted if a saving is to be effected on transport.

Southern Rhodesia Veterinary Report

AUGUST, 1951.

General.—Winter conditions gradually faded away with comparatively high temperatures being recorded at the end of the month. Rainfalls of from ½ to 3 inches were recorded in various parts of the Colony.

Grazing on the whole, with the exception of overstocked areas, has held out well. New grass growth is recorded and deaths have been reported from super purgation. To date no mortality from poverty has been reported, and the recent showers have filled dams and the prospects at present are extremely favourable.

A general improvement in the condition of cattle is evident.

Tick Life.—Ticks are becoming increasingly active. Despite the severe cold experienced in June and July, the seasonal abatement of tick life was not evident.

Mostly, dipping at fortnightly intervals is carried out, but there is a certain percentage of stock owners who have had to cease dipping, owing to the lack of water near dipping tanks. It is noted that five dipping tanks in the Melsetter District have ceased to function, owing to cracks following earth tremors.

Quarantine Orders issued were: Gwelo 4, Salisbury 2, Bulawayo 3; a total of 9.

SCHEDULED DISEASES.

1. **African Coast Fever.**—Nil.

2. **Theilerioses.**—All centres of infection have been declared free from disease and the farms removed from quarantine.

3. **Anthrax.**—The annual inoculation of native cattle on certain farms in the Insiza District is proceeding.

4. **Foot and Mouth Disease.**—Further spreads were confirmed in Victoria District as follows:—

2-8-51: Salemore spread from Lothian.
7-8-51: Lemoenfontein spread from Rhodebasch.
21-8-51: Morgenster Mission spread from Longdale.

The first two farms were inoculated on the 11th August and the cattle, together with the Zimbabwe Reserve, on the 25th August. This involved 2,369 head. The total number of cattle inoculated since the beginning of the outbreak is 58,441.

The reactions on Salemore and Lemoenfontein were 51 and 33 per cent. respectively. This is difficult to account for. The inoculant was collected two days previously from Lochinvar, where the reactions were severe, and yet the same inoculant was used on Morgenster where 83 per cent. reaction was recorded. It was further noted that the native cattle on Salemore and Lemoenfontein gave a 100 per cent. reaction. Further virus was collected and both farms were re-inoculated.

PIG INFECTION.

Lothian, Fort Victoria.—Temperature reactions were noted in all inoculated pigs. Two suckling pigs were showing 105 degrees by the third day with heavy vesiculation and marked lameness. One died on the 4th day, the other on the 6th day. On the 3rd day it was noted that any attempt to eat was followed by vomition of the ingested material. Gastric and intestinal tympany with marked abdominal pain was recorded as a constant factor for about 12 to 24 hours previous to death. The disease spread to the seven other contacts of the two inoculated suckling pigs, and the complete litter of nine had died within 10 days of the inoculation date.

The baconers showed typical vesiculation and lameness within three days of inoculation, but continued eating and had an uneventual recovery.

In the sty, where diluted virus was added to the drinking water, temperature reaction began on 3rd day, 103.5 degrees, reached 105 degrees on the 4th day when pigs were showing severe systematic reaction with immediate vomition of any ingested material. No vesiculation could be found in any of these pigs. On the 6th day eating was resumed, and by the 8th day pigs were back to normal. Challenge by virus inoculation on the 10th day gave no reaction whatever.

Four other weaners died on 4th to 6th day of natural reaction, and post mortem findings were similar to those of inoculated animals.

Post Mortem Finding.—Vesiculation only in feet, mostly in posterior third of interdigital space. Coronets inflamed in most pigs with detachment as posterior third and heels without vesiculation, but marked haemorrhagic inflammation of the coronory corium. Bulbs of the claws showed a heavy haemorrhagic infiltration. No mouth or snout vesiculation observed although parotid, mandibular and sublingual salivary glands showed marked haemorrhagic infiltration. Acute myocardial degeneration with pericarditis associated with marked ichorous exudate. Intense haemorrhagic gastro-intestinal inflammation with peritonitis giving copious haemorrhage exudate. Tympany is marked in all cases, and one pig actually contracted a fatal volvulus on the 5th day.

By the 7th August, about 60 per cent. of the pigs had had the infection, and 100 per cent. infection had been reached by the 16th August, 28 days from first infection.

In the Gwelo District infection was confirmed on the farm Chieftain on the 15th August; the farm adjoins the previously infected farm Duntroon. The cattle, 373 in number, were inoculated on the 23rd August. In order to create a cattle-free belt against Central Estates, 83 head of cattle on the farm Crossmaloof were brought on to Chieftain and inoculated, the reaction percentages on both places was 91.

5. **Glanders or Farcy.**—Nil.

6. **Heartwater.**—Heartwater inoculation of calves on a ranch in Matabeleland continues, 311 head being inoculated during August, making a total of 2,453 for the year. No further inoculations will be undertaken until the next crop of calves comes forward. Mortality from natural infection, nil.

7. **Mange.**—Nil.

8. **Pluro Pneumonia.**—Nil.

9. **Epizootic Lymphangitis.**—Nil.

10. **Piroplasmosis.**—Umtali 1, Melsetter 7, Gwelo 1, Salisbury 2, Bulawayo 2; Total 13.

11. **Rinderpest.**—Nil.

12. **Swine Fever.**—Nil.

13. **Swine Erysipelas.**—Nil.

14. **Quarter Evil.**—Umtali, 4 outbreaks with a mortality of 18; Bulawayo, 5 outbreaks.

15. **Tuberculosis.**—

1. **Importations:** Cattle tested 63; reactors 1; inconclusive 2.
2. **Exportations:** Cattle tested 262; reactors 2.
3. **Umtali Eradication Scheme:** Only 2 cows tested; 1 retest passed and 1 addition passed.
4. **Salisbury:** 4 cows tested; all passed.
5. **Meat Inspection: Cattle**—Condemned 3 carcases, 6 forequarters, 37 heads, 4 necks, 4 ribs, 88 plucks.

   Pigs—Condemned 2.

16. **Scab.**—Nil.

17. **Rabies.**—

Bulawayo: Bulalima Mangwe, 2 cases confirmed. Clinicals: Shangani 2, Belingwe 1, Bulalima Mangwe 3; Total 6. Dogs vaccinated 13,585. Total number of confirmed since outbreak 52. Total number of cats and dogs destroyed 3,327.

Umtali: Rabies was confirmed in district on the 13th August, 1951. Within 10 days a total of 4 cases was confirmed. Dogs vaccinated 1,351. Dogs and cats destroyed 146.

Melsetter: Confirmed 1 dog. Total confirmed since outbreak 11. Clinicals 5. Dogs destroyed 325. Cats destroyed 42. Vaccinated 7,125 dogs. All dogs in the Melsetter and Chipinga native districts have now been inoculated.

Gwelo: No change. Total since outbreak confirmed 3. Total number of dogs destroyed is 72.

Fort Victoria: Confirmed cases Victoria District 4. Clinicals 1, Bikita Clinicals 1, Gutu Clinicals 1. Number of dogs destroyed 3,074. Total number of dogs destroyed since outbreak 6,944. Total number of dogs vaccinated is 26,893.

18. **Senkobo Skin Disease.**—Nil.

19. **Trypanosomiasis.**—Bulawayo, Umtali, Gwelo, Melsetter and Fort Victoria, no reports.

Salisbury: The position at Mkoto is extremely unsatisfactory. Deaths are reported regularly. Tsetse has been picked up all over the Reserve, the south-eastern section being the worst infected area.

At present the position in the Urungwe Reserve is satisfactory.

20. **Contagious Epididymitis and Vaginitis.**—

Salisbury: Infection confirmed on three farms in the Marandellas and one in the Lomagundi North Districts. One farm was released from quarantine in the Lomagundi.

Fort Victoria: Confirmed on one ranch in the Bikita District.

Bulawayo: Confirmed in the Belingwe District on one ranch. One release in the Insiza District.

21. **Lumpy Skin Disease.**—Nil.

22. **Contagious Abortion.**—

Bulawayo: Confirmed on three farms.

SCHEDULED POULTRY DISEASES.

23. **Spirochaetosis.**—Nil.

24. **Coccidiosis.**—Nil.

25. **Fowl Typhoid.**—One outbreak in Bulawayo District.

26. **Bacillary White Diarrhoea.**—Nil.

27. **Tuberculosis.**—Nil.

28. **Chicken Pox.**—Reported in Salisbury District.
Roup.—4 cases.

NON-SCHEDULED DISEASES.

29. **Anaplasmosis.**—Salisbury 9, Bulawayo 2; Total 4.

30. **Paratyphoid.**—Nil.

31. **Geilseikte.**—Nil.

32. **Horsesickness.**—Nil.

33. **Biliary Fever (Horses).**—One.

34. **Sweating Sickness.**—Nil.

35. **Ophthalmia.**—Incidence low.

36. **Screw Worm.**—Incidence low.

37. **Coccidiosis.**—Nil.

38. **Poisoning.**—

(a) **Arsenical:** Bulawayo 17, Salisbury 21; Total 38.
Cyanide: Bulawayo 1.
Veld: Gwelo 9, Bulawayo 1. Heavy mortality reported from Melsetter.

39. **Ephemeral Fever.**—Nil.

40. **Malignant Catarrhal Fever.**—Nil.

Mallein Testing.—69 horses were tested, all with negative results.

Tuberculin Testing.—

Importation: 4 bulls and 6 cows were tested; all negative.

Exportation: 6 bulls, 84 cows, 107 heifers and 65 yearlings were tested; all negative.

Miscellaneous: 5 bulls, 28 cows, 12 heifers, 10 yearlings were tested; all negative.

IMPORTATIONS.

Bechuanaland: 1 goat, 31 pigs, 139 sheep.

Union of South Africa: 5 bulls, 6 cows, 10 heifers, 16 mares, 3 stallions, 56 geldings, 16 goats, 1 pig, 15 sheep.

United Kingdom: 1 heifer.

Eire: 2 stallions.

EXPORTATIONS.

Northern Rhodesia: 17 donkeys, 284 heifers, 1 pig, 2 horses.

Bechuanaland: 400 heifers.

Portuguese East Africa: 14 heifers, 6 slaughter cattle.

Belgian Congo: 434 heifers, 4 bulls, 12 horses.

Union of South Africa: 1 stallion.

EXPORTATIONS—MISCELLANEOUS.

Union of South Africa: 8,372 lbs. sausage casings.

Northern Rhodesia: 14,938 lbs. bacon, 2,543 lbs. smalls.

Bechuanaland: 277 lbs. bacon, 358 lbs smalls.

Belgian Congo: 19,142 lbs. offals, 526 lbs. sausage casings.

Portuguese East Africa: 14,323 lbs. sausage casings.

Meat Products from Liebigs (Rhodesia) Ltd., West Nicholson.

Union of South Africa: 205,740 lbs. corned beef, 54,000 lbs. Vienna sausages (24/10 oz.), 2,868 lbs. Vienna sausages (48/4 oz.), 18,000 lbs. steak and kidney, 788 lbs. stewed beef, 7,680 lbs. braised steak, 28,800 lbs. braised steak and onions, 6,528 lbs. braised liver, 4,200 lbs. ox tail in jelly, 6,000 lbs. curried beef, 1,609 lbs. assorted meat paste.

Belgian Congo: 98,100 lbs. corned beef.

J. S. ADAMSON,
Director of Veterinary Services.

SEPTEMBER, 1951.

General.—The weather continued to get warmer and very high temperatures were recorded towards the end of September. Rain of from ½ to 2 inches was recorded, but unfortunately it was not sufficiently widespread, but the falls helped the very weak position of water supplies. Water supplies have been very poor indeed, cattle having to trek considerable distances to drink.

The general condition of cattle though poor has not deteriorated during the month, and it is anticipated that mortality from poverty will be low.

The fresh growth of grass has withered. Veld fires during the month have not been as extensive as usual, this has helped cattle considerably.

Tick Life.—Ticks are reported from all districts to have become increasingly active. Farmers are urged to resort to weekly dipping as soon as water supplies are sufficient for this purpose. Unfortunately, in some districts dipping is virtually non-existent, and where possible fortnightly dipping is undertaken. Owing to the petrol shortage, inspections under the Cattle Cleansing Act were abandoned with the exception of the Eastern Districts.

Quarantine orders issued were: Bulawayo 1, Salisbury 2, Gwelo 2; Total 5.

SCHEDULED DISEASES.

1. **African Coast Fever.**—Nil.
2. **Theilerioses.**—Nil.
3. **Anthrax.**—Nil.
4. **Foot and Mouth Disease.**—All cordons have been removed in the Victoria Veterinary District with the exception of Morgenster, Mzero, Salemore, Lemoenfontein B., and Zimbabwe Reserve. It is noted that excellent reactions up to 100 per cent. to field virus were obtained on Morgenster, Mzero and Zimbabwe Reserve, and yet the reactions on Lemoenfontein B. were low. A second injection was given with no better results. This herd is being closely watched in case infection is simmering, but there appears to be no evidence of this. In the Gwelo District the cattle inoculated on Chieftain with field virus gave good results, 91 per cent. being recorded.
5. **Glanders or Farcy.**—Nil.
6. **Heartwater.**—1 death in Gwanda, 2 in Bulalima-Mangwe, and 1 in Belingwe; Total 4.
7. **Pleuro Pneumonia.**—Nil.
8. **Mange.**—Nil.
9. **Epizootic Lymphangitis.**—Nil.
10. **Piroplasmosis.**—Salisbury 2, Melsetter 4, Umtali 1; Total 7.
11. **Rinderpest.**—Nil.
12. **Swine Fever.**—Nil.
13. **Swine Erysipelas.**—An outbreak of a sub-acute type occurred on a farm in the Salisbury District. One death was recorded and nine head recovered following the application of homologous serum and penicillin therapy.

This is the third outbreak recorded in the Salisbury District during the year.

14. **Quarter Evil.**—Salisbury 4 outbreaks, Bikita 1, Umtali 1, Gwelo 1; Total 7 outbreaks.

15. **Tuberculosis.**—

1. **Importations:** Cattle tested 35. Re-tested 7 cows—All reacted. All the reactors were imported from the Union of South Africa.

2. **Exportations:** Cattle tested 17—All negative.

3. **Umtali Eradication Scheme:** 5 Clinical cases removed from a farm on the "B" Scheme.

4. **Meat Inspection:** Bulawayo Cold Storage—1 carcase condemned; Liebigs Factory—2 carcases, 3 fores, 2 hinds, 24 heads, 29 plucks condemned.

5. **Tuberculin Tests:** On a low veld ranch 41,268 head of cattle were tested with the single Mammalian test, of which 4,144 reacted. The reactors have been segregated.

Umtali: 2 cows tested.

Melsetter: 114 head tested—1 positive, 1 doubtful.

Salisbury: 2 herds tested, a total of 82, giving 5 doubtful reactors. In the one herd non-specific infection was established.

16. **Scab.**—Nil.

17.—**Rabies.**—

Bulawayo: 1 dog confirmed.

Belingwe: 1 dog confirmed; 2 Clinical.

Nyamandhlovu: 2 dogs Clinical; Total number of dogs destroyed 3,333; Total number of dogs vaccinated to 20-9-51 is 26,013.

Salisbury: 2 dogs were confirmed and 2 Clinical cases occurred in the Hartley District. Block inoculation of the European area was resorted to and 2,547 dogs were vaccinated.

Marandellas: Owing to the proximity of the Wedza and Ziyambi Native Purchase area to Makoni infection, it was decided to inoculate all dogs in the district, 2,037 dogs being vaccinated. 64 dogs were destroyed in the Hartley District.

Umtali: 1 case confirmed.

Makoni: 2 cases confirmed. Vaccination of dogs in the Umtali and Makoni Districts are being undertaken, and to date 9,528 dogs have been treated.

Melsetter: No cases confirmed. In all 7,169 dogs have been vaccinated; 326 dogs and 42 cats have been destroyed.

Gwelo: 1 dog confirmed.

Charter: I dog confirmed. To date inoculation of dogs has not been undertaken owing to paucity of supplies. Dogs destroyed 89.

Fort Victoria:

Chibi: 1 Clinical case.

Gutu: 1 confirmed case. Dogs destroyed 3,172; dogs vaccinated 8,380. Grand total of dogs vaccinated over the territory is 55,674.

It is noted that in areas where the avianised vaccine was first used, such as Bulawayo, Nyamandhlovu, Fort Victoria and Melsetter, there is a remission in the number of rabies cases. The vaccination of dogs is proving an exceedingly useful adjunct to the usual control measures.

18. **Senkobo Skin Disease.**—Nil.

19. **Trypanosomiasis.**—Melsetter 1 case, Fort Victoria 1; Salisbury 60 deaths. With the exception of the Mtoko Reserve, the position is not alarming. In the Urungwe Reserve 16 cases were proved and 3 near Miami. The treatment of infected cattle has been held up on account of the staff being tied up with Rabies inoculations.

20. **Contagious Epididymitis and Vaginitis.**—

Bulawayo: 2 further centres of infection confirmed. 1 farm released from quarantine.

Salisbury: 1 centre confirmed and 1 release. Position unchanged elsewhere.

21. **Lumpy Skin Disease.**—Nil.

22. **Contagious Abortion.**—

Bulawayo: Confirmed on 2 farms.

Salisbury: Confirmed on 1 farm.

Melsetter: Confirmed on 1 farm.

SCHEDULED POULTRY DISEASES.

23. **Spirochaetosis.**—Nil.

24. **Coccidiosis.**—Outbreaks in Umtali and Salisbury Districts.

25. **Fowl Typhoid.**—Outbreaks in Umtali and Salisbury Districts.

26. **Bacillary White Diarrhoea.**—Nil.

27. **Tuberculosis.**—Nil.

28. **Chicken Pox.**—Reported in the Salisbury District.

Roup.—2 cases in the Salisbury District.

NON-SCHEDULED DISEASES.

29. **Anaplasmosis.**—Bulawayo 4, Salisbury 4; Total 8.

30. **Paratyphoid.**—Nil.

31. **Geilseikte.**—Nil.

32. **Horsesickness.**—Nil. Inoculation of horses now in progress.

33. **Biliary Fever (Horses).**—Bulawayo 1 horse.

34. **Sweating Sickness.**—Nil.

35. **Ophthalmia.**—Nil.

36. **Screw Worm.**—Little.

37. **Coccidiosis.**—1 outbreak in Fort Victoria.

38. **Poisoning.**—

(a) **Arsenical:** Bulawayo 3, Salisbury 12, Melsetter 3; Total 18.

(b) **Lead:** Bulawayo 1.

(c) **Veld:** Bulawayo 51, Salisbury 1, Umtali 1; Total 53.

39. **Ephemeral Fever.**—Reported from Fort Victoria.

40. **Malignant Catarrhal Fever.**—Melsetter 2.

41. **Tetanus.**—Bulawayo 1 horse.

Mallein Testing.—39 horses were tested, all with negative results.

Tuberculin Testing.—

Importations: 3 bulls, 10 cows, 7 calves were tested—All negative.

Exportations.—Nil.

Miscellaneous.—Nil.

IMPORTATIONS.

Union of South Africa.—3 bulls, 10 cows, 15 heifers, 7 calves, 13 mares (3 foals), 2 stallions, 24 geldings, 43 sheep, 70 pigs, 4 rams.

Bechuanaland.—215 sheep.

United Kingdom.—1 pig.

EXPORTATIONS.

Belgian Congo.—408 heifers, 120 donkeys, 12 horses.

Union of South Africa.—5 pigs, 2 horses, 6 slaughter oxen, 1 mare.

Bechuanaland.—427 heifers.

Northern Rhodesia.—15 bulls, 3 pigs, 4 turkeys, 576 heifers, 1 horse.

Nyasaland.—22 heifers.

Portuguese East Africa.—9 slaughter oxen.

EXPORTATIONS—MISCELLANEOUS.

Union of South Africa.—14,214 lbs. sausage casings, 852 lbs. ox gall.

Portuguese East Africa.—3,116 lbs. sausage casings.

Belgian Congo.—22,857 lbs. offals.

United Kingdom.—10,020 lbs. gammons, 10,020 lbs. shoulders, 22,500 lbs. picnic hams.

Northern Rhodesia.—4,017 lbs. ¾ sides, 6,062 lbs. middles, 1,265 lbs. gammons, 2,563 lbs. cooked shoulders, 565 lbs. sliced bacon, 493 lbs. cooked gammons, 2,470 lbs. smalls.

Bechuanaland.—135 lbs. middles, 15½ lbs. gammons, 5½ lbs. picnic hams, 92½ lbs. cooked shoulders, 176 lbs. sliced bacon, 24 lbs. cooked gammons, 360 lbs. smalls.

Meat Products from Liebigs (Rhodesia) Ltd., West Nicholson.

Union of South Africa.—27,360 lbs. corned beef, 600 lbs. brisket, 1,875 lbs. Vienna sausages, 315 lbs. canned stewed beef, 32,400 lbs. braised steak, 32,400 lbs. braised steak and onions, 1,800 lbs. braised liver, 2,100 lbs. oxtail in jelly, 2,400 lbs. curried beef, 18 lbs. potted meat.

J. S. ADAMSON,
Director of Veterinary Services.

RHODESIAN MILK RECORDS

SEMI-OFFICIAL MILK RECORDS

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average Percentage B. Fat.	No. of Days.	Name and Address of Owner.
No. 30	G. Friesland	3 years	7460·00	249·07	3·34	285	M. G. Arkwright, Windrush, Marandellas.
No. 33	G. Friesland	Mature	8685·00	287·21	3·31	277	
No. 37	G. Friesland	3 years	8310·50	251·46	3·03	300	
No. 292	G. Friesland	Mature	8865·00	321·65	3·63	300	
Billie	G. Friesland	2 years	7570·00	266·23	3·52	300	Ashby Bros., P.B. 24, Gwelo.
Bunty	G. Friesland	4 years	5388·00	226·81	4·21	266	
Flossie	G. Friesland	3 years	6148·50	225·58	3·67	300	
Grace	G. Friesland	3 years	6177·00	229·72	3·70	300	
Bagatelle	G. Friesland	Mature	8099·00	277·31	3·42	266	R. A. Ballantyne, P.O. Box 801, Salisbury.
Cash	G. Friesland	Mature	6156·00	226·87	3·69	300	
Engagement	G. Friesland	Mature	7364·00	300·68	4·08	300	
Fido	G. Friesland	Mature	6151·00	255·06	4·14	300	
Fife	G. Friesland	Mature	8577·00	265·92	3·10	253	
Francis	G. Friesland	Mature	6657·00	246·85	3·71	223	
Transvaal (Sold)	G. Friesland	Mature	6833·00	246·15	3·60	199	
Maureen	G. Friesland	Mature	7389·90	266·76	3·61	300	N. G. Barrett, Gavenny, Rusape.
Albertvale Bokagen Van 6/387	P.B. Friesland	Mature	7191·60	251·97	3·50	281	J. A. Baxter, P.O. Box 1368, Salisbury.
Albertvale Lena XXII	P.B. Friesland	Mature	8184·00	261·60	3·20	300	
Albertvale Umpoekoe IX	P.B. Friesland	Mature	10504·40	334·73	3·19	300	
Grimethorpe C	G. Friesland	Mature	8413·80	307·23	3·65	300	
Lewisi	G. Friesland	Mature	6821·20	239·18	3·51	300	
Blackie	G. Friesland	3 years	7709·50	279·98	3·63	300	R. E. Bennett, P.O. Box 164. Umtali.
Morrie	G. Friesland	4 years	9113·60	329·16	3·61	300	

Dirko Roland's Maandag..	P.B. Friesland.....	4 years	8502·00	313·07	3·68	300	A. L. Bickle, P.O. Box 595, Bulawayo.
Helenvale Johanna.....	P.B. Friesland.....	Mature	16216·70	499·26	3·07	300	
D. 73.....	G. Friesland.....	Mature	7712·30	265·38	3·44	300	
D. 218.....	G. Friesland.....	Mature	7621·70	269·16	3·53	300	
D. 222.....	G. Friesland.....	Mature	10074·10	304·39	3·02	300	
D. 252.....	G. Friesland.....	4 years	8732·40	275·99	3·16	300	
D. 296.....	G. Friesland.....	3 years	8429·40	284·50	3·38	300	
Destiny VIII.....	G. Friesland.....	Mature	6792·50	257·26	3·79	300	Mrs. M. Black, Burnside Farm, Bindura.
Mavis II.....	G. Friesland.....	Mature	6869·50	228·74	3·33	300	
Bess.....	G. Jersey.....	4 years	5880·00	293·41	4·99	300	V. E. Bourdillon, Marydown P.O. Borrowdale.
No. 188.....	G. Friesland.....	Mature	8689·00	279·77	3·27	300	C. Boyd Clarke Mount Zonga, Invazura.
No. 198	G. Friesland.....	Mature	6474·00	257·52	4·00	300	
No. 331.....	G. Friesland.....	Mature	7060·00	239·45	3·39	300	
No. 404.....	G. Friesland.....	4 years	7063·00	273·03	3·86	300	
Grove Park Shorty II.....	G. Friesland.....	Mature	6574·00	228·47	3·48	243	Bradley Bros., P.O. Box 699, Bulawayo.
Beauty.....	G. Friesland.....	Mature	8430·00	278·30	3·30	300	The B.S.A. Co., P.O. Mazoe.
Lulu.....	G. Friesland.....	3 years	6520·00	241·24	3·70	300	
Sunshine.....	G. Friesland.....	3 years	7385·00	240·74	3·26	278	
Perry Blonde Miss.....	P.B. Jersey.....	3 years	6066·00	314·45	5·18	300	M. W. Burras, P.O. Box 443, Bulawayo.
Janet.....	G. Ayshire.....	Mature	5495·00	265·20	4·83	227	L. E. O. Cary, Clovelly, Trelawney.
No. 50.....	G. Friesland.....	Mature	11164·00	369·93	3·31	300	Cross & Son, P.B.T. 208, Bulawayo.
No. 63.....	G. Friesland.....	Mature	8369·00	297·05	3·55	276	
No. 65.....	G. Friesland.....	Mature	10744·00	336·54	3·13	300	
No. 81.....	G. Friesland.....	Mature	7867·00	268·17	3·41	300	
No. 111.....	G. Friesland.....	4 years	9576·00	299·61	3·13	249	
No. 120.....	G. Friesland.....	4 years	11972·00	392·00	3·27	300	
Lucky.....	G. Guernsey.....	3 years	5888·00	265·13	4·50	300	J. A. Dallas, Chigwell Extension, Hartley.
Adolph.....	G. Friesland.....	Mature	6251·00	226·43	3·62	300	A. B. Dobson, Endeavour Farm, P.O. Norton.
Bioscope.....	G. Friesland.....	Mature	6266·40	246·22	3·93	300	
Buttercup.....	G. Friesland.....	Mature	7250·10	234·54	3·23	300	
Edna.....	G. Friesland.....	Mature	6041·90	234·91	3·89	300	

SEMI-OFFICIAL MILK RECORDS(—continued)

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average Percentage B. Fat.	No. of Days.	Name and Address of Owner.
Maverick	G. Friesland	3 years	6744·50	239·14	3·54	300	
Sadzi	G. Friesland	Mature	5816·00	239·30	4·11	300	
Sophia	G. Friesland	4 years	6026·30	243·03	4·03	300	
Umvuma	G. Friesland	Mature	6839·60	274·48	4·01	300	
No. 22	G. Guernsey	4 years	5681·00	256·89	4·52	278	B. St. J. D. Downs, Safago Farm, P.B. 6, Gwelo.
Princess Margaret	G. Friesland	2 years	6903·90	255·42	3·70	300	R. I. Edwards, P.O. Box 25, Chipinga.
Queen Alexandria	G. Friesland	Mature	8747·40	332·11	3·80	300	
Royal Lady	G. Friesland	Mature	6576·10	294·36	4·48	300	
Alice	G. Friesland	Mature	8294·80	266·48	3·21	300	H. J. Elliott, Flintell, Umtali.
Jane	G. Friesland	Mature	6649·50	247·06	3·72	300	
Mary	G. Friesland	Mature	6813·50	257·30	3·78	300	
Castle Zonga Elsa I	P.B. Friesland	Mature	6102·00	270·95	4·44	244	Mrs. M. Everard, Castle Zonga, Inyazura.
No. 318	G. Friesland	Mature	8212·00	275·03	3·30	300	
No. 358	G. Friesland	Mature	7403·00	239·38	3·20	300	
Agnes	G. Jersey	3 years	6147·50	319·13	5·19	288	Mrs. M. I. Field, Stratford, Trelawney.
Buttons	Common	3 years	5290·00	250·09	4·73	296	
Mafuta	G. Jersey	3 years	4857·00	232·09	4·78	246	
Mary	G. Common	Mature	6364·50	315·26	4·95	290	
No. 15	G. Friesland	3 years	10567·00	358·01	3·39	294	Mrs. H. C. Fischer, Olivia Farm, Headlands.
No. 39	G. Friesland	3 years	11345·00	373·01	3·29	300	
No. 52	G. Friesland	2 years	10608·50	380·82	3·59	300	
Np. 1	G. Friesland	3 years	8243·00	283·02	3·43	300	R. le S. Fischer, Wakefield Farm Headlands.
No. 6	G. Friesland	2 years	8458·00	292·60	3·46	300	
No. 9	G. Friesland	2 years	8020·00	296·10	3·69	300	
No. 15	G. Friesland	2 years	6084·00	228·34	3·75	300	
No. 21	G. Friesland	19 Months	8024·00	311·82	3·89	300	
No. 245	G. Friesland	Mature	8750·00	314·80	3·60	300	
No. 268	G. Friesland	4 years	6784·00	229·87	3·39	251	
No. 322	G. Friesland	3 years	7068·00	257·04	3·64	300	
No. 325	G. Friesland	3 years	7298·00	263·66	3·61	260	

Auntie Annie	G. Friesland	3 years	5780·50	237·97	4·12	281	G. J. Franklin & Son, P.O. Box 105, Umtali.
Beulah	G. Friesland	Mature	11014·00	395·84	3·59	300	
Fern	G. Friesland	Mature	12184·00	439·42	4·04	300	
Feruka	G. Guernsey	3 years	5473·50	232·86	4·25	255	
Ganganda III	G. Friesland	Mature	7290·50	342·68	4·70	247	
Ginger	G. Friesland	3 years	10521·50	371·91	3·53	300	
Melsetter	G. Friesland	3 years	6814·50	242·20	3·55	275	
M'Plate II	G. Friesland	Mature	7416·50	329·37	4·44	300	
Nola	G. Friesland	3 years	8255·00	282·03	3·42	300	
November	G. Friesland	Mature	5967·50	250·67	4·20	275	
Perkins	G. Friesland	3 years	8999·00	343·21	3·81	300	
Sandra	G. Friesland	4 years	7306·00	334·61	4·58	300	
Socks II	G. Friesland	Mature	9431·50	373·35	3·96	300	
Spitfire	G. Friesland	Mature	7748·50	275·39	3·55	232	
Town	G. Friesland	3 years	7158·50	257·23	3·59	300	
Victoria	G. Friesland	3 years	8070·50	348·60	4·30	269	
Kanda	G. Friesland	Mature	7138·90	270·59	3·79	277	P. Freeland, Lingfield, P.O. Gwelo.
Maria	G. Friesland	Mature	6803·20	276·66	4·06	300	
No. 33	G. Friesland	Mature	6070·50	237·23	3·91	300	
No. 53	G. Friesland	4 years	7706·90	266·18	3·45	300	
No. 64	G. Friesland	3 years	5974·50	248·93	4·17	300	
No. 96 A	G. Friesland	Mature	7517·60	307·03	4·08	300	
No. 137	G. Friesland	Mature	8000·70	281·98	3·53	300	
No. 197	G. Friesland	Mature	6390·60	236·33	3·70	300	
Agathia	P.B. Friesland	Mature	7439·90	254·44	3·42	300	G. G. Futter, Marjoribanks, P.O. Gwelo.
Juliana	G. Friesland	4 years	8794·50	305·94	3·48	300	Mrs. H. D. Gamble, P.O. Box 1629, Salisbury.
No. 37	G. Friesland	Mature	8916·00	347·98	3·90	300	R. T. Garvin, P.O. Box 242, Umtali.
No. 43	G. Friesland	2 years	8110·00	333·35	4·12	300	
Amy	G. Friesland	Mature	9015·00	335·10	3·72	300	Hon. H. V. Gibbs, P.B. 52L, Redbank, Bulawayo.
Greta	G. Friesland	Mature	10137·00	315·75	3·11	300	
Mouse	G. Friesland	Mature	6091·00	269·63	4·43	247	
Poppy	G. Friesland	Mature	12939·00	425·86	3·50	300	
Barlows Vergelegen Jill	P.B. Jersey	4 years	7801·00	456·09	5·85	300	Gov. Dem. Farm, P.O. Karoi.
Barlows Vergelegen Marina	P.B. Jersey	4 years	4481·50	284·51	6·35	292	
Barlows Vergelegen Redwing Diamond	P.B. Jersey	4 years	7264·50	361·98	4·93	300	
Fairseat Oxfordia's Primrose	P.B. Jersey	3 years	5782·50	281·26	4·86	300	
Myrtle	G. Jersey	4 years	6417·00	342·40	5·34	300	
Queen	G. Jersey	4 years	8831·50	434·75	4·92	300	

SEMI-OFFICIAL MILK RECORDS—(continued)

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average Percentage B. Fat.	No. of Days.	Name and Address of Owner.
No. 59	G. Friesland	3 years	7967·50	301·57	3·78	300	Gwebi College of Agriculture, P.B. 76B, Salisbury.
No. 64	G. Friesland	3 years	8875·00	323·87	3·65	300	
No. 68	G. Friesland	3 years	8289·00	276·84	3·34	300	
No. 5	G. Friesland	4 years	8674·00	261·98	3·02	300	The Marquis of Graham, Derry Farm, Nyabira.
No. 13	G. Friesland	4 years	7119·50	251·01	3·51	292	
Abundance	G. Friesland	4 years	6758·70	296·68	4·39	300	E. E. C. Green, Mutzarara, P.O. Melsetter.
Mary II	G. Guernsey	2 years	5184·00	238·77	4·61	300	E. J. Hards, P.O. Box 61, Marandellas.
Beauty	G. Guernsey	Mature	6309·40	295·88	4·69	300	D. A. Harley, Harleyton, P.O. Beatrice.
Dallas	G. Guernsey	Mature	5373·70	235·21	4·38	300	
Lucy II	G. Guernsey	Mature	5802·60	252·76	4·36	300	
Maggie	G. Guernsey	Mature	4239·00	235·06	5·55	300	
Maud	G. Guernsey	Mature	5887·40	259·56	4·41	300	
Queenie II	G. Guernsey	Mature	5356·70	232·09	4·33	300	
Sarah	G. Guernsey	Mature	7059·40	289·48	4·11	300	
Gladsmuir Sandy Shalot	P.B. Jersey	Mature	5610·50	288·84	5·15	300	Home Park Estates, P.O. Macheke.
Flop	G. Friesland	4 years	6712·00	237·33	3·54	248	D. J. Huddy, P.O. Box 718, Salisbury.
Gwen	G. Friesland	Mature	7969·50	247·22	3·12	300	
Kitty	G. Friesland	Mature	6846·00	265·66	3·88	300	
Merry	G. Friesland	Mature	10074·50	324·36	3·22	300	
Molly	G. Friesland	Mature	8691·00	305·27	4·43	300	
Muggy	G. Friesland	4 years	7641·50	267·94	3·51	300	
Peggy	G. Friesland	Mature	9011·50	302·95	3·36	300	
Phyllis	G. Friesland	Mature	6470·00	237·47	3·67	207	
Rosella	G. Friesland	Mature	12437·00	376·04	3·02	300	
Rosemary	G. Friesland	Mature	6910·00	288·26	4·17	232	
Sarah	G. Friesland	Mature	6982·50	234·68	3·36	300	
Sassie Boom	G. Friesland	3 years	6368·50	239·21	3·75	273	
Winkie	G. Friesland	4 years	8762·00	320·90	3·66	300	

Africa	G. Friesland	4 years	5906·50	244·85	4·15	281	L. Huddy, P.O. Box 924, Salisbury.
Chiota	G. Friesland	Mature	8685·00	276·50	3·18	300	
Clover	G. Friesland	Mature	8452·50	319·08	3·77	277	
Joan	G. Friesland	Mature	7786·00	269·50	3·46	300	
Leja	G. Friesland	Mature	9356·50	287·96	3·07	300	
Rose	G. Guernsey	Mature	11531·50	360·80	3·13	300	
Emma	G. Shorthorn	Mature	4582·00	227·08	4·14	282	Mrs. M. R. Huddy, P.O. Box 899, Salisbury.
Queenie	G.L.R. Shorthorn	Mature	5606·00	256·21	4·57	300	
Zambesi	G.L.R. Shorthorn	Mature	6424·00	278·11	4·33	300	
Cream	G. Friesland	Mature	8238·50	278·48	3·38	300	J. A. G. Hughes, Bain's Hope, P.O. Melfort.
Reno	G. Friesland	Mature	10401·00	357·47	3·44	283	
J. 6/1	G. Friesland	Mature	9563·00	333·91	3·50	300	J. Jamieson, P.O. Box 217, Bulawayo.
J. 57/1/2	G. Friesland	Mature	8724·00	291·67	3·34	239	
J. 58/1/1	G. Friesland	4 years	15885·00	542·95	3·50	300	
J. 66/2/4	G. Friesland	3 years	8913·00	372·55	3·80	300	
J. 67/3/1	G. Friesland	4 years	15228·00	548·02	3·60	300	
No. 8	G. Friesland	Mature	7583·00	263·82	3·61	209	R. Gordon Kay, P.O. Box 606, Bulawayo.
No. 35	G. Friesland	Mature	12435·00	408·79	3·29	300	
No. 38	G. Friesland	Mature	8859·00	312·84	3·53	300	
No. 43	G. Friesland	3 years	9529·00	327·68	3·44	300	
No. 45	G. Friesland	Mature	9574·00	289·07	3·03	300	
No. 57	G. Friesland	Mature	7721·00	236·56	3·06	300	
Violet	G. Friesland	4 years	6657·00	246·01	3·70	300	G. Kileff, P.O. Box 1944, Salisbury.
Kingston Bandie	G. Friesland	Mature	7028·00	271·37	3·86	282	Kingston Farm Syndicate, P.O. Box 2, Bindura.
Kingston Jokie	G. Friesland	Mature	7541·00	321·10	4·26	284	
Kingston Mary	G. Friesland	4 years	8393·00	306·92	3·66	300	
Kingston Odol	G. Friesland	Mature	7575·00	227·44	3·00	264	
Kingston Town	G. Friesland	Mature	9114·00	319·20	3·50	300	
Rosandra	G. Friesland	Mature	7669·50	254·05	3·31	300	Mrs. M. M. Krahner, Haydock Park, Banket.
No. 2	G. Friesland	Mature	6762·50	250·47	3·70	300	H. T. Lay, P.B. 107c, Salisbury.
No. 3	G. Friesland	2 years	7021·90	275·25	3·92	300	
No. 22	G. Friesland	Mature	6404·70	241·44	3·76	300	
No. 24	G. Friesland	Mature	6734·60	279·12	4·14	300	
No. 26	G. Friesland	Mature	6874·10	270·16	3·93	300	
No. 40	G. Friesland	Mature	6389·00	238·20	3·66	300	

SEMI-OFFICIAL MILK RECORDS—(continued)

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average Percentage B. Fat.	No. of Days.	Name and Address of Owner.
Petal	P.B. Friesland	3 years	6654·00	252·77	3·80	300	J. MacIntyre, P.O. Box 58, Shamva.
Willoxton Coralinn	P.B. Ayshire	4 years	6957·00	308·17	4·43	300	
Betty	G. Friesland	Mature	7624·10	283·98	3·72	286	D. W. Marshall, P.O. Box 164, Umtali.
Lucy	G. Friesland	Mature	8116·40	367·63	4·53	300	
Rosalie	G. Jersey	3 years	6087·70	312·89	5·14	300	Lt. Col. C. I. F. Maynard, P.B. 112c, Salisbury.
Minhinick Glen	P.B. Friesland	4 years	8940·00	296·10	3·31	300	J. U. McCay, P.B. J181 ,Bulawayo.
No. 75	G. Friesland	Mature	9414·00	318·66	3·38	300	
No. 85	G. Friesland	Mature	7058·00	235·34	3·33	300	
No. 130	G. Friesland	Mature	8613·00	294·23	3·42	300	
No. 133	G. Friesland	Mature	7843·00	259·95	3·31	300	
No. 140	G. Friesland	Mature	9770·00	303·03	3·10	300	
No. 165	G. Friesland	4 years	6811·00	229·36	3·37	300	
Anetta	G. Friesland	Mature	7321·70	291·54	3·98	285	J. H. McLean, P.O. Box 161 Gwelo.
Bulawayo III	G. Friesland	Mature	8414·10	323·00	3·84	300	
Ponskop	G. Red Poll	Mature	6770·70	279·40	4·13	300	
Red Poll I	G. Red Poll	Mature	7268·80	286·26	3·94	300	
Sallie I	G. Friesland	Mature	7996·30	277·71	3·47	269	
Skin	G. Friesland	Mature	9160·00	351·67	3·84	300	
Spoon II	G. Friesland	Mature	6559·30	238·00	3·63	300	
No. 47	Common	Mature	6361·90	248·37	3·90	300	
Eleanor	G. Friesland	Mature	10232·00	310·21	3·03	300	L. McLean, P.O. Box 285, Gwelo.
Jessie	G. Friesland	Mature	7171·00	279·43	3·90	300	
No. 0	G. Arshire	Mature	7844·00	317·17	4·04	300	
No. 4	G. Friesland	Mature	7637·00	253·45	3·32	247	
No. 9	G. Friesland	Mature	7765·00	268·20	3·45	300	
No. 15	G. Friesland	Mature	7233·00	258·18	3·57	275	
No. 28	G. Friesland	Mature	9653·00	306·76	3·18	300	
No. 60	G. Friesland	Mature	10750·00	381·99	3·55	300	
No. 68	G. Friesland	4 years	11211·00	372·09	3·32	300	
No. 73	G. Friesland	4 years	8987·00	290·18	3·23	275	
No. 75	G. Friesland	4 years	8720·00	318·20	3·65	300	

P 12/7	P.B. Friesland	3 years	6338·00	239·10	3·77	300	Thos. Meikle Trust & Invest. Co., Leachdale, Shangani.
P 33/5	P.B. Friesland	4 years	7573·00	240·76	3·18	292	
G 3/2	G. Friesland	Mature	10600·00	332·94	3·14	300	
G 16/3	G. Friesland	Mature	7273·00	263·19	3·62	300	
No. 217 (Sold)	G. Red Poll	Mature	6364·00	272·76	4·29	171	A. L. Millar, P.B. 28A, Salisbury.
Dora	G. Ayshire	3 years	5436·00	247·38	4·55	300	R. L. Moffat, Ormiston Farm, Shangani.
Joaz	G. Ayshire	Mature	6640·00	321·92	4·85	300	
Medusa	G. Ayshire	3 years	5206·00	242·87	4·65	300	
Sally	G. Ayshire	Mature	5210·00	254·13	4·88	266	
Maisie	G. Ayshire	Mature	5658·00	227·20	4·02	300	Commander E. Morant, P.O. Box 741, Salisbury.
Violet	G. Ayshire	4 years	6133·00	275·75	4·49	300	
Blanche	G. Guernsey	Mature	5714·00	249·91	4·36	252	G. R. Morris, P.O. Box 1040, Salisbury.
Castiglione	G. Friesland	Mature	7842·00	260·59	3·45	262	
Grace	G. Guernsey	Mature	6023·00	227·97	3·78	295	
Irene	G. Guernsey	Mature	6325·00	234·53	3·71	300	
Livorno	G. Guernsey	3 years	6889·00	265·81	3·86	300	
Marmite	G. Friesland	Mature	5942·00	241·00	4·05	246	
Napoli	G. Friesland	Mature	8438·00	297·74	3·53	250	
Rapallo	G. Friesland	4 years	6469·00	236·91	3·66	286	
Venezia	G. Friesland	Mature	5766·00	254·21	4·41	291	
Odzi	G. Friesland	4 years	6121·40	226·57	3·70	300	J. T. Mungle, Myreside, Odzi.
Dokitor	G. Friesland	Mature	7052·00	249·98	3·55	300	K. Norval, P.O. Box 637, Bulawayo.
Babs IV	G. Friesland	2 years	6781·00	230·91	3·41	300	E. Palmer, Ferndale, Penhalonga.
Belle V	G. Friesland	2 years	7608·20	264·10	3·47	300	
Dolly	G. Friesland	4 years	7606·30	349·73	4·60	274	
Katie	G. Friesland	Mature	9099·20	364·07	4·00	251	
Norris	G. Guernsey	Mature	9677·30	380·12	3·93	309	
Pixie	G. Friesland	4 years	8868·20	295·61	3·33	283	
Queenie III	G. Friesland	4 years	7263·80	272·94	3·76	295	
Socks	G. Friesland	Mature	9247·80	382·59	4·14	266	
Stella III	G. Friesland	2 years	6901·10	237·40	3·44	300	
Alison	G. Friesland	Mature	12637·00	387·14	3·06	300	J. D. Parsons, P.O. Box 7, Bulawayo.
Betty	G. Friesland	Mature	14883·00	486·33	3·27	300	
Blom	G. Friesland	3 years	10329·00	370·36	3·59	300	
Breach	G. Friesland	3 years	13026·00	418·38	3·11	300	
Election	G. Friesland	Mature	11507·00	360·13	3·13	300	

SEMI-OFFICIAL MILK RECORDS—(continued)

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average Percentage B. Fat.	No. of Days.	Name and Address of Owner.
P. 4A	P.B. Friesland	Mature	6579·00	228·50	3·47	300	T. C. Pascoe, P.O. Box 1253, Salisbury.
117A	G. Friesland	2 years	8690·00	273·13	3·14	300	
Albertvale Marion	P.B. Friesland	3 years	10516·00	404·84	3·85	300	G. W. Robinson, P.O. Box 346, Salisbury.
Alpha	G. Friesland	Mature	8952·60	328·70	3·67	300	
Topaz	G. Friesland	Mature	7143·00	277·50	3·88	300	
No. 14	G. Friesland	Mature	8184·10	273·35	3·34	300	
No. 57 2nd	G. Friesland	3 years	7934·20	271·76	3·45	300	
No. 86	G. Friesland	4 years	7047·30	237·94	3·38	300	
Elizabeth	G. Friesland	3 years	6444·40	252·41	3·92	286	W. F. H. Scutt, Maple Leaf, Norton.
June	G. Friesland	Mature	7266·20	244·22	3·36	273	
Luben	G. Friesland	Mature	8748·60	312·72	3·57	300	
Polly	G. Friesland	Mature	8225·10	281·64	3·42	300	
William	G. Friesland	4 years	6818·60	233·06	3·42	300	
Blue	G. Friesland	Mature	6407·00	243·68	3·80	300	D. Shand, P.B. 61L, Bulawayo.
No. 35	G. Friesland	Mature	9189·50	300·09	3·27	300	
Cherry	G. Friesland	Mature	6341·50	246·65	3·89	300	L. F. Sheffield, Orange Park, P.O. Macheke.
Maria	G. Shorthorn	Mature	6636·50	232·40	3·50	300	
Beauty II	G. Friesland	Mature	7696·00	310·67	4·04	275	E. Tapson Trust, Ltd., Lesapi Falls, Rusape.
Box	G. Friesland	Mature	6046·00	228·34	3·77	286	
Buhera	G. Friesland	Mature	6893·00	265·44	3·85	241	
Chichaka II	G. Friesland	3 years	8048·00	260·71	3·24	288	
Escombe	G. Friesland	4 years	7591·00	283·91	3·74	300	
Gracie	G. Friesland	Mature	6516·00	232·18	3·60	256	
Mariana	G. Friesland	4 years	7638·00	283·40	3·70	300	
Matensen III	G. Friesland	Mature	10618·00	352·38	3·32	298	
Pricska	G. Friesland	3 years	6547·00	254·54	3·89	238	
Umtali	G. Friesland	Mature	9303·00	335·54	3·60	300	

Boy	G. Friesland	Mature	7694·70	282·34	3·67	300	A. W. Tennent, Kelvin, Headlands.
Connie	G. Friesland	Mature	13236·80	434·69	3·21	300	
No. 11	G. Friesland	Mature	7996·40	287·70	3·60	300	
No. 13	G. Friesland	Mature	7570·60	276·15	3·65	300	
No. 24	G. Friesland	Mature	6720·20	296·24	4·40	300	
No. 25	G. Friesland	Mature	7199·10	268·34	3·73	300	
No. 47	G. Friesland	4 years	8058·10	309·55	3·84	300	
No. 52	G. Friesland	4 years	9153·40	344·35	3·76	300	
No. 53	G. Friesland	4 years	7437·30	305·28	4·15	300	
Redleaf Ardent	P.B. Red Poll	Mature	4994·00	225·33	4·51	300	J. G. Thurlow, Atherstone, Bindura.
Chitora Lora	G. Friesland	Mature	6115·00	268·57	4·39	300	P. S. Timms, Chitora, Rusape.
Nancy	G. Friesland	Mature	6888·00	268·92	3·90	300	
Tulip II	G. Friesland	Mature	6526·00	249·14	3·80	300	
Black	G. Friesland	Mature	5953·00	276·31	4·64	300	W. White, Goromanzi Estate, P.O. Ruwa.
Patch	G. Friesland	Mature	4921·00	225·65	4·59	300	

RHODESIA

Agricultural Journal

ISSUED BY

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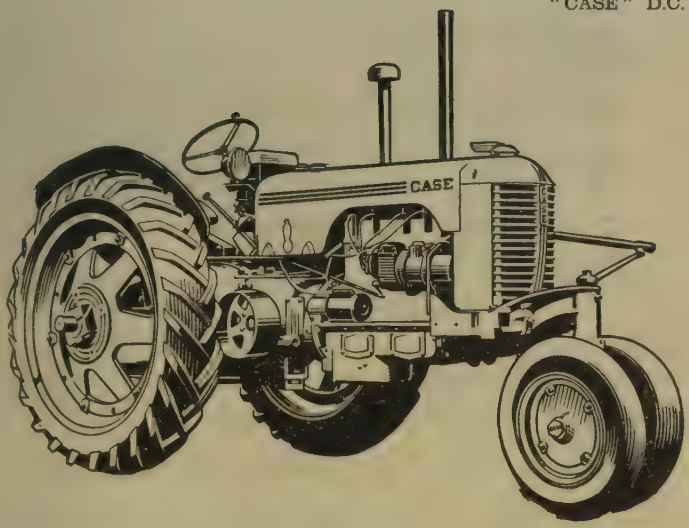

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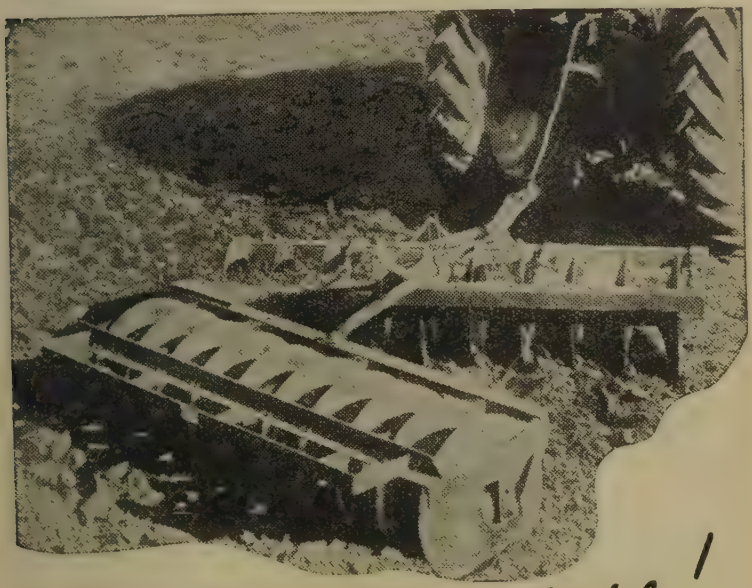

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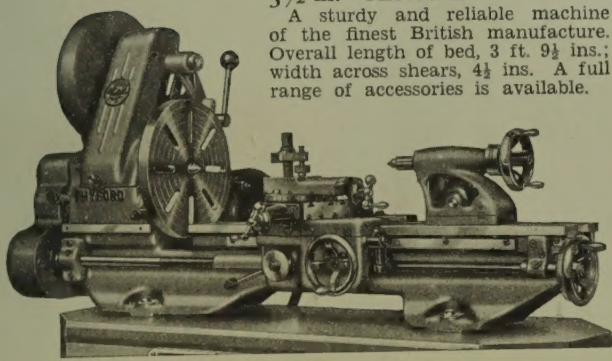

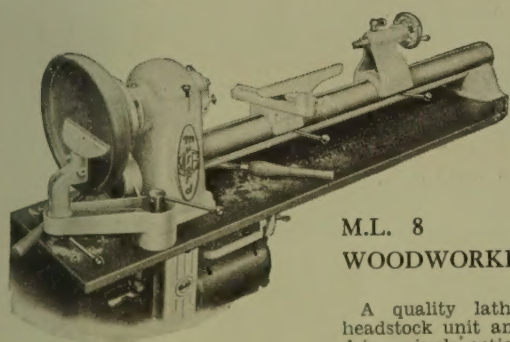

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